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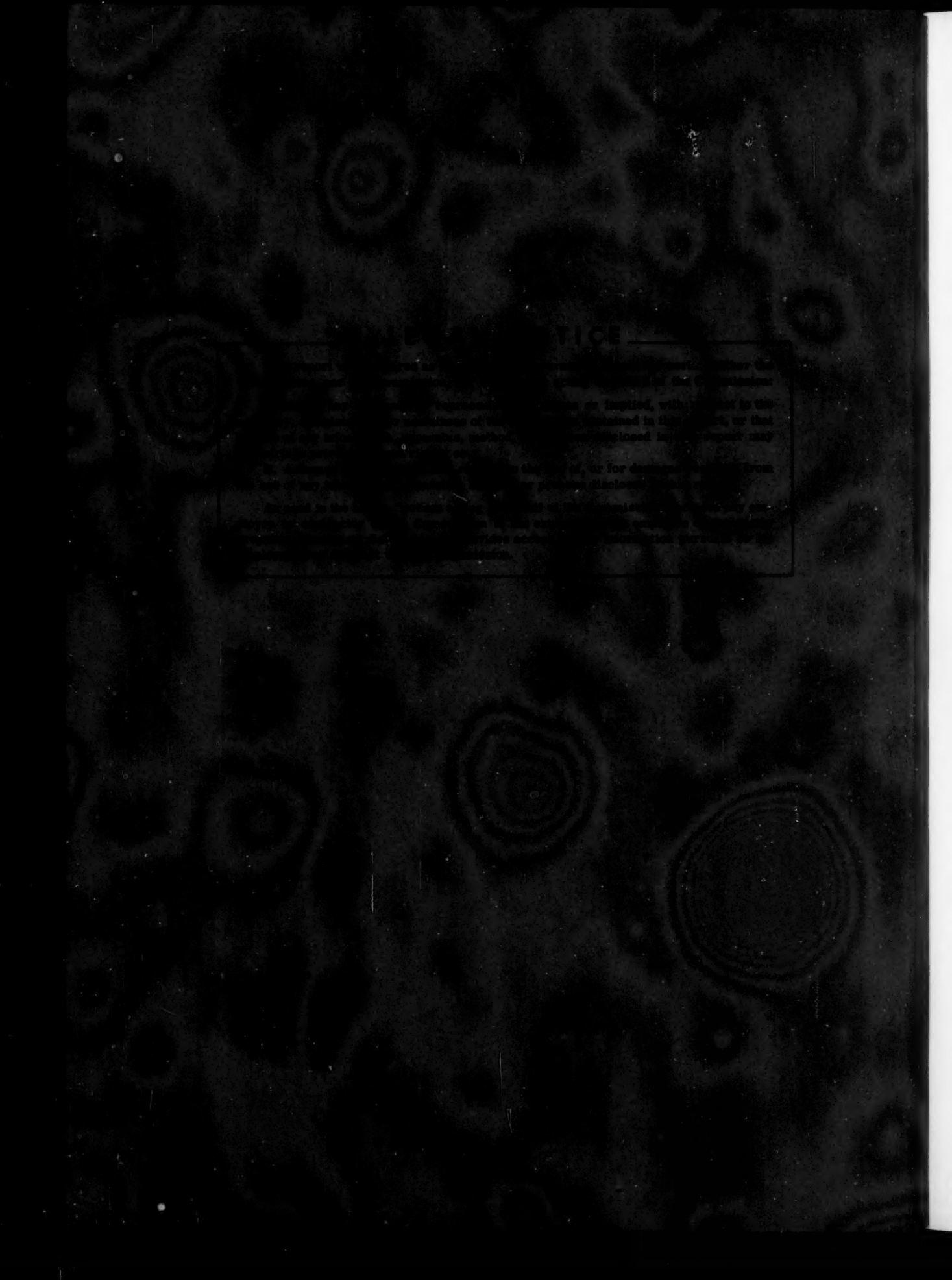

NUCLEAR SCIENCE ABSTRACTS

Volume 11 January 15, 1957 No. 1

GENERAL

1 TID-7516(Pt. 1)
Division of Nuclear Materials Management, AEC.
AEC MATERIALS MANAGEMENT-CONTRACTOR REPRESENTATIVES MEETING, WASHINGTON, D. C., MAY 7-9, 1956. 272p. $1.50(OTS).

Papers are presented which were delivered at a joint meeting of AEC and contractor personnel for the purpose of discussing methods for nuclear material control. Topics discussed include auditing, chemical and physical measurements, and applications of mathematical statistics. The policies prescribed by the AEC and the practices effected by the contractors in working out specific cases and applications are discussed. A broad range of problems encountered in Commission and SS materials management work is covered: Included are procedures for the measurement of consumption of U^{235} in a reactor, the coulometric determination of Pu and U, the x-ray spectrographic determination of U, and a complexing agent-ammonium phosphate method for the analytical separation of U. (C.H.)

ATOMIC POWER

2 AD-79731
Tracerlab, Inc., Boston.
INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER. Final Report (No. 12 in the Series) [for] August 1, 1954 to October 31, 1955. Alexander Thomas and Imogene DiBello. 66p. DA Project No. 3-99-09-022. Contract DA-36-039-SC-64519.

A description of the improvements in construction and techniques which have led to a reduction in the temperature coefficient of voltage are discussed. Also included are the first observations on the reduction in sluggishness of current and voltage by radiation conditioning of the new all-inorganic insulation type models. Initial experiments directed towards still further improvements in current and voltage response characteristics, particularly at extremes of cold, are described. Where it is appropriate to the present outlook for the gaseous ionization contact potential difference type battery, general progress has been summarized. (auth)

3
NUCLEAR POWER FOR COMMERCIAL VESSELS. V. K. Maddocks. Atomics 7, 347-53(1956) Oct.

A survey of British and American information relative to the use of nuclear power for marine propulsion is included. Five types of reactor suitable for marine use and one type suitable for fuel production have been described and illustrated. The gas cooled reactor is selected as most suitable for marine propulsion and a proposed closed cycle gas turbine plant is analyzed in some detail. Various proposals for the use of nuclear power in specific ships have been reviewed, and an economic analysis is made to compare a 30,000 ton d.w. tanker when operating with an oil fired steam turbine plant and when operating with a nuclear-powered closed-cycle helium turbine. (auth)

4
PRODUCTIVE USES OF NUCLEAR ENERGY. THE OUTLOOK FOR NUCLEAR POWER IN JAPAN. Michael Sapir and Sam J. Van Hyning. Washington, National Planning Association, 1956. 175p. $3.00.

A survey was made to explore the need for an alternate source of power in Japan, to define the competitive conditions which nuclear power must satisfy, to suggest some possible short- and long-term economic effects of competitive nuclear power, and to define problems which might arise from nuclear power development. (F.S.)

5
ATOMS IN BUSINESS. Forum Report No. 10. James Greene, ed. New York, Atomic Industrial Forum, Inc., 1956. 152p. $5.00.

Commercial and international developments in atomic energy were outlined at a meeting held May 1956 in San Antonio, Texas. The general categories considered were the ABC's of atomic energy, putting the atom to work, energy in the future, role of management, materials and equipment, atomic energy in the southwest, atomic power in Latin America, and business opportunities. (W.L.H.)

6
PROSPECTS FOR ATOMIC ENERGY IN THE SOUTH. A Forum Report. James Greene and Edwin A. Wiggin, eds. New York, Atomic Industrial Forum, Inc., 1956. 174p. $5.00.

Papers and discussions on the prospects for atomic energy in the South are presented. Topics such as the role of management in atomic energy, the importance of atomic energy to the South, prospects for atomic electric power, present and prospective applications of radioisotopes, the importance of research, the atomic energy industry in the Southeast, industry-education-government cooperation, and special problems in atomic energy are discussed. (J.H.M.)

7
URANIUM AND THE ATOMIC INDUSTRY. Forum Report No. 11. Oliver Townsend and James Greene, eds. New York, Atomic Industrial Forum, Inc., 1956. 183p. $5.00.

Various phases of these general topics are discussed: uranium production, industry's part in the atomic power program, future demands and requirements, AEC's program and policies, competitive energy sources, developments in Canada, and related aspects. (T.R.H.)

8
METALLURGICAL PROBLEMS IN NUCLEAR-POWER PRODUCTION. Ivor Jenkins. J. Inst. Metals 84, 475-82 (1956) Aug.

9
THE CYLINDER X-RAY SPECTROMETER. J. C. M. Brentano (Northwestern Univ., Evanston, Ill.). Physica 22, 705-6(1956) Aug.

Factors which affect intensities obtained from the cylinder x-ray spectrometer are reviewed. (J.H.M.)

10
SOME TOPICS IN THE ECONOMICS OF ATOMIC ENERGY. S. M. Feinberg and S. A. Skvortsov. Soviet J. Atomic Energy, No. 2, 231-42(1956).

A survey is made of published material on topics in the economics of atomic energy. (B.J.H.)

11
SOME PROBLEMS OF ATOMIC POWER DEVELOPMENT IN THE USSR. I. V. Kurchatov. Soviet J. Atomic Energy, No. 3, 283-9(1956).

The development of atomic power in the USSR is surveyed, and some of the problems in the design of water-moderated reactors are reviewed. (B.J.H.)

RESEARCH PROGRAMS

12 BNL-406
Brookhaven National Lab., Upton, N. Y.
QUARTERLY PROGRESS REPORT [FOR] APRIL 1–JUNE 30, 1956. (Unclassified Section). 56p. $0.40(OTS).

Summaries of papers presented for publication are presented. Routine cosmotron operation, accelerator development studies, reactor operation, plans for the expansion of medical research facilities, health physics activities, and studies for the improvement of radiation detection instruments are reported. Progress is reported in a number of studies by the medical department. Data are presented on the following: the preparation of At^{211} and the labeling of serum albumin, gamma globulin, and fibrinogen with At^{211}; tracer studies of plasma lipoprotein metabolism in normal individuals and in children with nephrotic syndrome; tracer studies of protein metabolism in mice; the radiosensitivity of acetylcholinesterase; tracer studies on the metabolism of Mn in mice; and the role of carbohydrate and mineral metabolism in the control of the cerebral excitatory state. (For preceding period see BNL-388.) (C.H.)

13
ATOMIC ENERGY IN CANADA. Clyde C. Kennedy. Chalk River, Atomic Energy of Canada Ltd., 1956. 97p. $1.00.

The main activities of Atomic Energy of Canada Limited are development of economic atomic power; fundamental research; operation of nuclear reactors and the production of nuclear fuels (Pu and U^{233}); and the production of radioactive isotopes and associated equipment. The history and a description of the programs of AECL are described. (F.S.)

14
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 1. THE WORLD'S REQUIREMENTS FOR ENERGY: THE ROLE OF NUCLEAR ENERGY. New York, United Nations, 1956. 479p. $8.00.

15
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 16. RECORD OF THE CONFERENCE. New York, United Nations, 1956. 203p. $5.00.

BIOLOGY AND MEDICINE

16
SINGLE CELL SPIKE ACTIVITY IN THE OLFACTORY BULB. Raymond R. Walsh (Brookhaven National Lab., Upton, N. Y.). Am. J. Physiol. 186, 255-7(1956) Aug.

17
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 12. RADIOACTIVE ISOTOPES AND IONIZING RADIATIONS IN AGRICULTURE, AND BIOCHEMISTRY. New York, United Nations, 1956. 553p. $9.00.

RADIATION EFFECTS

18 AECU-3351
Chicago. Univ. Dept. of Medicine.
THE ROLE OF BACTERIAL INFECTION IN RADIATION INJURY. C. Phillip Miller. [Dec. 28, 1955]. 16p. Contract AT(11-1)-46. (M-5828). $3.30(ph OTS); $2.40 (mf OTS).

19 LA-1986
Los Alamos Scientific Lab., N. Mex.
BIOLOGICAL EFFECTS OF INHALATION OF HIGH CONCENTRATIONS OF TRITIUM GAS. T. T. Trujillo, E. C. Anderson, and W. H. Langham. Dec. 1955. 37p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00(mf OTS).

The hazard resulting from inhalation of unoxidized tritium (T_2 or HT) in relatively high concentration was investigated. Mice were made to inhale an atmosphere containing 1% tritium gas (20 curies per liter) and the rate of fixation of tritium as HTO in the body fluids was determined. The animals fixed an LD_{50}^{30} dose of tritium as tritium water (1.5 mc/cc of body fluids, equivalent to ~800 rep total body exposure) in about 45 min. during which time the calculated total dose to the lung surfaces was ~135,000 rep. No histological evidence of acute lung changes from the very high doses of β radiation was observed. The 30-day survival curve of the mice inhaling 1% tritium gas was compared with that of animals given tritium water (HTO) by intraperitoneal injection. The results showed no significant difference in the LD_{50}^{30} of mice exposed by inhalation of tritium gas and mice that received equivalent amounts of HTO by injection. From these results it was concluded that the additional large β radiation exposure of the alveolar surfaces resulted in no additional acute stress to the animal. It appears, therefore, that the fixation of tritium as HTO in the body fluids is the limiting factor with regard to acute inhalation exposure to tritium gas. (auth)

20 UCRL-3480
California. Univ., Berkeley. Radiation Lab.
INCORPORATION OF PHOSPHORUS-32 INTO DNA OF REGENERATING LIVER: THE EFFECT OF IRRADIATION. Lola S. Kelly, J. Dorothy Hirsch, Genevieve Beach, and Wynne Palmer. July 24, 1956. 13p. Contract W-7405-eng-48. $0.15(OTS).

Following a massive dose of CCl_4 in mice, a time study was made on the 2-hr incorporation of P^{32} into liver DNA and on the mitotic activity of liver cells. An increase in P^{32} incorporation began 30 hr after CCl_4, with a maximum at about 40 hr. Mitotic activity was not apparent until after DNA synthesis had reached its maximum. The radiation experiments showed that DNA synthesis was depressed when the mice were irradiated 0, 12, 72, or 96 hr after CCl_4, but that it was not affected when the radiation was given between 24 and 48 hr after CCl_4. Mitotic activity was absent 5 hr after radiation, began to return at 14 hr, and reached the control value at 26 hr. The results indicate that separate mechanisms are responsible for the effects of irradiation on DNA synthesis and on mitotic activity in liver. (auth)

21 UCSF-13
California. Univ., San Francisco. School of Medicine. Radiological Lab.
SEMIANNUAL REPORT FOR PERIOD ENDING JUNE 30, 1956. July 1956. 22p. Contract AT-11-1-GEN-10, Project No. 2. $4.80(ph OTS); $2.70(mf OTS).

Physics. Routine operation of the synchrotron is reported. The calibration of dosimeters for use in studies employing the synchrotron beam is discussed. Biology. Progress is reported in the following studies: determinations of the relative biological effectiveness of 1000-kvp

x radiation for a number of biological test objects; the influence of strain on the acute x radiation lethality in the mouse; the radiosensitivity of hamsters; late effects of whole-body x irradiation on the mouse; and the effects of partial-body irradiation in the dog. A list of papers published, or accepted for publication, during the period is included. (For preceding report see UCSF-12.) (C.H.)

22

ALKALINE PHOSPHATASE ACTIVITY IN VARIOUS MOUSE TISSUES FOLLOWING TOTAL BODY X-IRRADIATION. Joseph L. Mollura and Anna Goldfeder (Dept. of Hospitals, New York and New York Univ.). Am. J. Physiol. 186, 224-6(1956) Aug.

The distribution of alkaline phosphatase in various mouse tissues (duodenum, spleen, liver, kidney and mammary glands) and the effects of ionizing radiation on the activity and distribution of this enzyme were studied by the use of the Gomori method. A total-body dose of 700 r, known to kill 50% of the mice of the C_{57}/BL6 strain in about 9 days, as well as doses up to 10,000 r, failed to produce any apparent change in alkaline phosphatase activity of the various tissues which were removed from 2 hours to 14 days after exposure. On the basis of these observations it may be inferred that alkaline phosphatase is not involved in cytological damage induced by ionizing radiation. (auth)

23

ENZYMATIC ACTIVITY OF RADIATED EXTERIORIZED SALIVARY GLANDS. James A. English (National Naval Medical Center, Bethesda, Md.). Am. J. Physiol. 186, 245-9(1956) Aug.

24

X-RAY STUDIES ON TOBACCO MOSAIC VIRUS. Anne Buzzell, David Trkula and Max A. Lauffer (Univ. of Pittsburgh). Arch. Biochem. Biophys. 63, 470-6(1956) Aug.

25

THE INFLUENCE OF HISTOLOGICAL STRUCTURE ON THE RADIOSENSITIVITY OF TUMOURS: A SYMPOSIUM. I. THE HISTOLOGICAL ASPECTS OF TUMOUR RADIOSENSITIVITY. R. W. Scharff and P. S. Andrews (Middlesex Hospital, London). Brit. J. Radiol. 29, 478-82(1956) Sept.

26

THE INFLUENCE OF HISTOLOGICAL STRUCTURE ON THE RADIOSENSITIVITY OF TUMOURS: A SYMPOSIUM. II. THE INFLUENCE OF SYSTEMIC FACTORS ON THE DIFFERENTIATION AND RADIOCURABILITY OF CERVICAL CANCERS. A. Glucksmann (Strangeways Research Lab., Cambridge, England). Brit. J. Radiol. 29, 483-7 (1956) Sept.

27

QUANTITATIVE OBSERVATIONS ON RECOVERY FROM WHOLE BODY IRRADIATION IN MICE. R. H. Mole (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Radiol. 29, 563-9(1956) Oct.

28

THE EFFECT OF X RAYS ON THE UPTAKE OF PHOSPHORUS 32 BY THE KNEE JOINT AND TIBIA OF SIX-WEEK-OLD MICE: RELATION OF DEPRESSION OF UPTAKE TO X-RAY DOSE. C. W. Wilson (Westminister Hospital, London). Brit. J. Radiol. 29, 571-3(1956) Oct.

29

ULTRAVIOLET SPECTROGRAPHIC DETERMINATION OF EARLY MODIFICATIONS IN BLOOD SERUM RESULTING FROM X RADIATION. B. M. Graevskaya and B. A. Orlov (Central Roentgen, Radiological, and Cancer Inst.). Doklady Akad. Nauk S.S.S.R. 108, 623-5(1956) June 1. (In Russian)

30

THE EFFECTS OF GAMMA RAYS FROM 20 MEV BETATRON AND FROM Co^{60} ON THE CELLULAR ELEMENTS AND SUGAR IN THE BLOOD OF RABBITS. P. F. Soldatenkov, V. A. Kostromskaya, and K. K. Yakovleva (Urals Acad. of Science). Doklady Akad. Nauk S.S.S.R. 108, 1065-8(1956) June 21. (In Russian)

31

PARTICLE AND STRONG RADIATION EFFECTS ON THE LUMINESCENCE OF ORGANIC MATTER. M. D. Galanin. (Lebedev Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 392-6(1956) Apr. (In Russian)

Emission spectra, luminescence, and the relation between the luminescence emission and the nature of charged particle energy are reviewed. Data on the rate of scintillation and rate of luminescence in photoexcited substances are analyzed. (R.V.J.)

32

ON SOME POSSIBLE HUMAN CONSEQUENCES OF THE EXTENSION OF THE USE OF IONIZING RADIATIONS. A. Lacassagne and H. Marcovich (Institut du Radium, Paris). J. belge radiol. 39, No. 4, 535-45(1956). (In French)

33

EXPERIMENTS ON THE X-RAY BACTERICIDES. M. Ponzio (Institut de Radiologie de l'Universite de Turin, Italy). J. belge radiol. 39, No. 4, 583-97(1956). (In French)

34

MUTATION RATES OF SEVERAL GENE LOCI IN NEUROSPORA. Val W. Woodward (Brookhaven National Lab., Upton, N. Y. and Kansas State Coll., Manhattan). Proc. Natl. Acad. Sci. U. S. 42, 752-8(1956) Oct.

35

EFFECT OF X-RAY DOSE ON MORTALITY AND SKIN TRANSPLANTABILITY IN MICE RECEIVING F_1 HYBRID MARROW. J. J. Trentin (Baylor Univ. Coll. of Medicine and Univ. of Texas Dental Branch, Houston). Proc. Soc. Exptl. Biol. Med. 93, 98-100(1956) Oct.

The 21-day LD_{50} under the conditions of x-irradiation used is approximately 600 r. Irradiation of CBA mice followed by intravenous administration of bone marrow suspension from Cb × CBA F_1 hybrids resulted in little or no 21-day mortality at 110, 330, 660 and 770 r, but in almost 100% mortality at 550 r. Homografts of Cb skin into the surviving mice were accepted by the mice at 660 and 770 r dose levels but not by mice at 0, 110 and 330 r dose levels. None of the marrow-treated mice at 550 r survived long enough to be skin grafted. (auth)

36

DELAYED EFFECTS OCCURRING WITHIN THE FIRST DECADE AFTER EXPOSURE OF YOUNG INDIVIDUALS TO THE HIROSHIMA ATOMIC BOMB. Robert W. Miller (Atomic Bomb Casualty Commission, San Francisco). Pediatrics 18, 1-18(1956) July.

Thirty-three children who were exposed while in utero to Hiroshima atomic bomb have head circumferences 2 or more standard deviations below normal. Twenty-four of these were between the seventh and fifteenth week of gestational age at the time of detonation of the bomb. The incidence and the severity of microcephaly increases as the distance from the hypocenter decreases. Mental retardation occurred in 15 of the 33 patients. The incidence of this defect was also related to distance from the hypocenter and gestational age. No other embryologic effects of exposure to the atomic bomb have been detected to date. In 6 years ending in December, 1954, 19 persons who were within 2100 meters of the hypocenter have developed leukemia before attaining the age of 19 years. The annual incidence of this disease among those who were within 1500 meters and who were younger than 10 years of age at the time of exposure

is 1:1000. There are no cataracts that impair vision among the present pediatric group. An increased incidence of a mild visual disability, the cause of which is thus far indefinite, has been found among those now 16 through 19 years of age who were within 1800 meters of the bomb center. The incidence of chronic otitis media is the same for the 2 exposure groups, as are the means of the hematologic values for the patients with this ailment. There is no increase in the tumor incidence of the exposed children as compared with the nonexposed. There are no data to prove it, but the impression is that among the survivors the fear of late effects may be common and potentially disabling. Of those 19 years of age and younger, there wer 2771 within 3000 meters of the hypocenter at the time of detonation of the bomb who were examined in 1954. Twenty-four of these had sequelae of the blast or thermal effects of the bomb other than well-healed scars. No other abnormalities related to atomic bomb exposure have been identified. (auth)

37

INVESTIGATION OF EXPERIMENTAL CANCER INDUCED BY LOCAL β-RADIATION. G. Schubert, H. A. Klinkel, L. Overbeck, and G. Uhlmann. Strahlentherapie 100, 335-51(1956) July. (In German)

By means of the continuous effect of β-radiating glass beads which had been implanted under the skin and into the peritoneum, 87 malignant tumors could be called forth in 214 rats. For the skin tumors (sarcomas and carcinomas) of the subcutaneous series the frequency of the tumors, the medium latent period and the period of epilation were dependent on the intensity of the Sr^{90}-beads. By local intra-abdominal ray effects hepato-cellular carcinomas could be provoked in border zones of liver hematomas. (auth)

38

CONCERNING THE VARIABLE DAMAGE TO THE PULMONARY TISSUE BY THERAPEUTIC X-RADIATION. Hans Cottier. Strahlentherapie 100, 385-98(1956) July. (In German)

Experiments in rats have shown that a single irradiation of the right lung with 3000 r does not lead to diffuse, uniform pulmonary lesions, but to inconstant, localized processes with transition into fibrosis. The causes of the localized apneumatoses (atelectasis, chronic pneumonia) are, in general, bronchial occlusions on the base of bronchitis. Atelectases in the irradiated pulmonary tissue show a high tendency towards fixation by connective tissue. Even 4 months after the irradiation 40% of the animals showed significant fibrosis. (auth)

39

DEPENDENCE OF THE LATENT PERIOD OF BIOLOGICAL RADIATION REACTION ON THE DOSAGE LEVEL. Felix Wachsmann and Apostolos Yiannakopoulos. Strahlentherapie 100, 428-32(1956) July. (In German)

The report deals with experiments concerning the dependence of the latent period of biological reactions on the height of irradiation doses. In pea germs the degree of retardation of the root growth is rising under increasing doses; not influenced is the latent period. In rat tails doses up to 100,000 r produced an effect on the latent period of epitheliolysis and necrosis, less on that of the erythema. An increase of the doses up to 15,000,000 r effected a further shortening of the latent period as well as a thinning of the tail. (auth)

40

EXPERIMENTAL INVESTIGATION OF THE QUESTION OF X-RAY SENSITIVITY OF BONE GROWTH IN ANIMALS. Pierre van Caneghem and Carl Georg Schirren. Strahlentherapie 100, 433-44(1956) July. (In German)

The report deals with the influence of x rays on the growth cartilages of the tarsometatarsal articulation of the chicken. A simple dose (half-value layer 0.9 mm Al) from 1200 r provokes a shortening, a dose from 2000 r causes a functional impotence. If the hardness of the radiation is diminished, the functional impotence increases, whereas the degree of shortening decreases. The fractionation reduces the intensity of the lesions contrary to the effect which can be observed in certain other tissues with speedy cellular multiplication. The experiments have been made, because there are similar problems in the irradiation of angiomas situated at the level of the articulations. (auth)

41

QUANTITATIVE AND QUALITATIVE CHANGES IN X-IRRADIATED CULTURE OF BONE MARROW. Irene Boll, Margarete Koppe, Johannes Schaaf, and Johannes Trautmann. Strahlentherapie 100, 445-54(1956) July. (In German)

42

ON THE BIOLOGICAL AND BIOCHEMICAL EFFECT OF IONIZATION RAYS. PART IV. URIC ACID EXCRETION OF RATS AFTER TOTAL X-IRRADIATION UNDER THE INFLUENCE OF ADENOSINE TRIPHOSPHORIC ACID. Hans-Joachim Maurer and Peter Schwarzmann. Strahlentherapie 100, 463-76(1956) July. (In German)

After total roentgen irradiation of 625 r the uric acid excretion of rats shows a wave-like course. After Doca the same changes can be stated. Here, however, the normalization seems to occur already after a shorter period. After administration of doses of adenosine triphosphoric acid an increased uric acid excretion before and after the irradiation could be observed. An influence on the radio-sensibility could not be found. (auth)

43

PREMATURE CHANGE IN BONES OF FULLY DEVELOPED GUINEA PIGS AFTER IRRADIATION. Rudolf Birkner, Julius Frey, and Karl-Heinz Ueberschär. Strahlentherapie 100, 574-90(1956) Aug. (In German)

The authors describe the early histological changes of the long bones of fully developed guinea-pigs after a single roentgen irradiation with 5000 r. As a direct consequence, the irradiation entails already during the first week a complete necrosis of the bone cells, which is considered the most significant criterion of the bone death. The tissue of the soft parts of the bones is less damaged and still starts slight reparative reactions, which, however, are stopped during the fourth week by the forthcoming changes in the parossal and compacta vessels. (auth)

44

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 11. BIOLOGICAL EFFECTS OF RADIATION. New York, United Nations, 1956. 402p. $8.00.

45

PROGRESS IN RADIOBIOLOGY. PROCEEDINGS OF THE FOURTH INTERNATIONAL CONFERENCE ON RADIOBIOLOGY HELD IN CAMBRIDGE ON 14TH TO 17TH AUGUST 1955. Joseph S. Mitchell, Barbara E. Holmes, and Cyril L. Smith, eds. London, Oliver and Boyd, 1956. 557p.

Recent studies in radiobiology and closely related studies are reviewed. Emphasis is placed on the importance of human data and the need for continued study of the fundamental basis of the biological action of radiations on living cells. The value of collaboration between investigators trained in a wide range of scientific disciplines is stressed as a necessity for progress in this field of scientific inquiry. (C.H.)

RADIATION HAZARDS AND PROTECTION

46 AERE-HP/R-2056

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIOSTRONTIUM FALLOUT IN BIOLOGICAL MATERIALS IN BRITAIN. F. J. Bryant, A. C. Chamberlain, A. Morgan, and G. S. Spicer. Sept. 5, 1956. 49p.

Methods are described for the determination of Sr^{90} due to fallout from nuclear explosions in soils, vegetation, bones, and milk. The results of measurements on British samples up to the spring of 1956 are given. The current levels in Britain are shown to be very similar to those reported for the United States. (auth)

47 AF-SAM-56-51

Utah. Univ., Salt Lake City. Coll. of Medicine.

SUSCEPTIBILITY TO ORAL INFECTION IN MICE AS A FUNCTION OF POSTIRRADIATION TIME. Eugene H. Perkins, David M. Donaldson, and Stanley Marcus. Nov. 28, 1955. 9p.

Total-body x irradiation resulted in increased susceptibility of mice to infections on the first, third, fourth, and fifth postirradiation days. No difference in mortality was observed if mice were challenged at later dates or 1, 2, or 3 days prior to x irradiation. Analysis of the data indicates that increased susceptibility to infection via the oral route following irradiation is dependent upon early damage to the gastrointestinal tract in conjunction with the depression of cellular and humoral defenses which develop at later postirradiation times. (auth)

48 CEA-455

France. Commissariat a l'Energie Atomique, Paris.

RECUEIL DE DONNEES NUMERIQUES ET DE DEFINITIONS. TOME II. PROTECTION — DOSIMETRIE. [Survey of Numerical Data and Definitions. Vol. II. Protection — Dosimetry]. Jean Combrisson. Nov. 23, 1954. 83p.

The definitions and units used in radiation dosimetry are listed. Data are included on radiation depth doses, personnel protection rules, tolerance doses, maximum permissible doses, characteristics of the "standard man," dose determinations from radioisotopes, calculation of γ doses, and calculation of β doses. (B.J.H.)

49 HW-41275

[Hanford Atomic Products Operation, Richland, Wash.]

COLUMBIA RIVER TRAVEL TIME MEASUREMENTS BY FLOAT METHODS. J. K. Soldat. Jan. 4, 1956. 18p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The travel time of the Columbia River between the most upstream reactor effluent discharge point and the Pasco and Kennewick city water plant intakes was measured by float methods. The main object of the studies was to measure the minimum travel time over the course at various river flow rates, but maximum and mean travel times were also obtained. A graph of travel time versus river flow rate was constructed for river flows in the range of 0.9×10^5 to 3.6×10^5 cu ft/sec. Minimum travel times from the most upstream reactor effluent water discharge point to the Pasco-Kennewick area were 22.4 hr at 0.9×10^5 cfs and 11.2 hr at 3.6×10^5 cfs. In a few of the tests, measurements of the travel time to points intermediate to Pasco were made and graphs of the results of these tests were constructed to indicate travel time versus distance downstream from the most upstream reactor. Reasonable agreement was obtained when comparisons were made between results of the float measurements and results of studies by the U. S. Corps of Engineers and results of the comprehensive river surveys conducted by J. F. Honstead prior to impoundment of the river by McNary Dam. (auth)

50 NYO-4712

New York Operations Office. Health and Safety Lab., AEC.

BACKGROUND RADIATION: A LITERATURE SEARCH. Wayne M. Lowder and Leonard R. Solon. July 1956. 45p. $0.30(OTS).

Information was abstracted from a representative group of scientific papers published within recent years which deal with the various aspects of natural radiation and with radioactive materials comprising various components of background. The information is classified into sections covering cosmic radiation, terrestrial radiation sources, and radiation from internal emitters. (179 references.) (C.H.)

51 NYO-4753

New York Operations Office, AEC.

ANNOTATED BIBLIOGRAPHY ON FALL-OUT RESULTING FROM NUCLEAR EXPLOSIONS. Allen G. Horad, Merril Eisenbud, and John H. Harley. Sept. 1956. 48p. $0.35(OTS).

This bibliography is limited to published articles and speeches concerning the various aspects of radiation effects resulting from fallout of nuclear explosions. Although some articles reflect instrumentation as used in respect to measuring the effects of fallout, no major attempt was made to include the field of instrumentation. The period covered is from August 1945 to September 1956. (auth)

52 ORNL-2151

Oak Ridge National Lab., Tenn.

HEALTH PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1956. Nov. 2, 1956. 103p. Contract W-7405-eng-26. $0.55(OTS).

Educational, training, and consultation activities engaged in during the period are reviewed. Publications during the period are listed. Data are presented from the following studies: the tissue distribution and excretion of U following injection in man, dogs, and rats; the design and performance of inhalation apparatus for the generation and quantitative delivery of uranium aerosols to dogs; the development of analytical procedures for the determination of Cs^{137} in fish muscle tissue; a mathematical analysis of factors affecting the distribution of radioisotopes in animal tissues; the lethal effects of γ radiation on soil microörganisms; the delayed effects of γ radiation on arthropods; studies on the life history and culture of arthropods; the design and performance of an aerosol entrainment well for use in studies of radioactive aerosols produced by hot reactor wastes; the concentration and decontamination of radioactive wastes by evaporation and liquid storage; tracer studies on the movement of radioactive wastes by evaporation and liquid storage; tracer studies on the movement of radioactive liquid wastes through soil; the influence of sand type on the performance of sand filters; the development of precipitation methods for the preparation of water samples for the radiometric determination of low level radioactive Cs, Zr, and Nb; the improvement of methods for the chemical removal of fission products from radioactive liquid wastes; tracer studies on the ion exchange properties of soils; the rate of leaching of fission products from shale; the development, calibration, and evaluation of radiation dosimeters; the relative ionization produced by Pu^{239} alpha particles in various gas mixtures; the relative biological effectiveness of moving ions of H, He, C, N, and O; and the preparation of depth-dose curves for neutron beams. (For preceding period see ORNL-2049.) (C.H.)

53

INHALATION AND RETENTION OF SIMULATED RADIOACTIVE FALL-OUT BY MICE. I. STUDY OF A SIMULANT OF FALL-OUT FROM NUCLEAR DETONATION UNDER SEA WATER. Stanton H. Cohn, William B. Lane, Joseph K. Gong, John C. Sherwin, and Walter L. Milne (U. S. Naval Radiological Defense Lab., San Francisco). Arch. Ind. Health 14, 333-40(1956) Oct.

The uptake, distribution, and retention of fission products in mice subjected to an acute inhalation exposure from fall-out simulant were investigated. The simulant, first of a series to be studied, contained the ionic form of three-day-old fission products from bombarded uranium. The fission-product mixture was developed in an attempt to represent the fall-out produced by a nuclear detonation in sea water. This simulant was aspirated as a liquid aerosol into three animal chambers, at three different concentrations simultaneously, for a period up to one hour. Data on tissue distribution are summarized. (auth)

54

EFFECT OF REDUCED LIVER AND KIDNEY CATALASE CONCENTRATIONS ON LETHALITY OF X IRRADIATION IN RATS. Wallace Friedberg (Oak Ridge National Lab., Tenn.). Proc. Soc. Exptl. Biol. Med. 93, 52-3(1956) Oct.

Liver and kidney catalase was markedly reduced in rats by the injection of 3-amino-1,2,4-triazole. X irradiation of these animals did not cause more deaths than in saline-injected control groups. It was concluded that differences in liver and kidney catalase levels cannot account for differences in sensitivity to the lethal effects of x irradiation. (auth)

55

THE HAZARDS TO MAN OF NUCLEAR AND ALLIED RADIATIONS. London, Her Majesty's Stationery Office, 1956. 128p. $0.99.

Existing scientific information on the biological effects of nuclear radiations is reviewed. The consequences to the individual and to society of increased environmental radioactivity are considered. It was concluded that, as with other sources of energy that man has harnessed to his service, the use of ionizing radiation entails risk, but the risk is controllable within limits that man can accept. The nature of the risks and the extent to which they can be controlled are discussed. (C.H.)

56

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 13. LEGAL, ADMINISTRATIVE, HEALTH AND SAFETY ASPECTS OF LARGE-SCALE USE OF NUCLEAR ENERGY. New York, United Nations, 1956. 393p. $7.00.

RADIOGRAPHY

57

PROCEDURES AND ERRORS IN QUANTITATIVE HISTORADIOGRAPHY. Jackson J. Clemmons (Univ. of Wisconsin Medical School, Madison). Biochim. et Biophys. Acta 17, 297-321(1956).

58

ANALYSIS OF THE RADIOACTIVE CONTENT OF TISSUES BY α-TRACT AUTORADIOGRAPHY. J. Rotblat and Gillian Ward (Medical Coll. of St. Bartholomew's Hospital, London). Phys. in Med. and Biol. 1, 57-70(1956) July.

RADIOTHERAPY

59

A CLINICAL PROGRAM TO EVALUATE THE PRACTICAL SIGNIFICANCE OF HIGHER ENERGY LEVELS THAN THE 1-3 MEV. Gilbert H. Fletcher (Univ. of Texas M. D. Anderson Hospital and Tumor Inst., Houston). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 866-94(1956) Nov.

Results are reviewed from a comparative evaluation of a kilocurie Co^{60} teletherapy unit versus a 22 Mev betatron in the radiotherapeutic management of cancers. (C.H.)

60

SOME OBSERVATIONS ON THE CLINICAL EFFECTS OF COBALT-60 TELECURIE THERAPY. C. C. Burkell and T. A. Watson (Cancer Clinic Saskatoon, Saskatchewan, Canada). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 895-904(1956) Nov.

Clinical experience has shown that Co^{60} telecurie therapy is a useful adjunct to the practice of radiotherapy. There has been less trouble with skin reactions; field selection and treatment plans have been simpler; and, in many cases, it has been possible to achieve higher tumor doses than with conventional roentgen rays. As a rule, tumor doses have been approximately 10% higher than those with conventional radiation in order to produce the same result. Doses higher than this have led to complications, such as cartilage necrosis, or when the lung was in the radiation path, pulmonary fibrosis. (auth)

61

CLINICAL ASPECTS OF BETATRON IRRADIATION. Lewis L. Haas and Roger A. Harvey (Univ. of Illinois Coll. of Medicine, Chicago). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 905-18(1956) Nov.

62

THE USE OF TANTALUM 182 IN THE TREATMENT OF EARLY BLADDER CARCINOMA. P. J. van Miert and J. F. Fowler (Royal Victoria Infirmary, Newcastle upon Tyne, England). Brit. J. Radiol. 29, 508-12(1956) Sept.

The methods available for dealing with early carcinoma of the bladder are briefly reviewed, and it is considered that more attention should be paid to the possibilities offered by interstitial irradiation, particularly in the matter of uniform and adequate dosage to the lesion-bearing area, and the reduction of dosage to unaffected areas of bladder to a minimum. New methods of using Ta^{182} wire to achieve these ends are described with illustrative cases. The physical principles governing uniformity of dosage in these implants are briefly discussed. (auth)

63

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 10. RADIOACTIVE ISOTOPES AND NUCLEAR RADIATIONS IN MEDICINE. New York, United Nations, 1956. 544p. $8.00.

TOXICOLOGY STUDIES

64 HW-42969

Hanford Atomic Products Operation, Richland, Wash. CHROMIUM TOXICITY IN PLANTS. J. H. Rediske. May 7, 1956. 15p. Contract W-31-109-Eng-52. $0.30(OTS).

Chromium(Cr^{6+}) is toxic to plants in concentrations as low as 18 mg Cr/ft^2 of soil when applied to the surface. At this concentration there is a delay in barley seed germination of 4 or 5 days, with a similar delay in development. Higher concentrations produce a general chlorosis which is accompanied by a reduction in dry weight, reduction in Fe and Mn uptake, and change in carbohydrate content. Chromium(Cr^{3+}) is less toxic than Cr^{6+}, requiring about ten times greater concentrations to produce the same effects. (auth)

65 NP-6136

Mine Safety Appliances Co., Callery, Penna.

HAZARDS OF USING A BIPHENYL-TYPE COOLANT: TOXICOLOGY AND FLAMMABILITY. Memo Report No. 119. J. W. Mausteller and K. R. Barker. Aug. 31, 1956. Includes attachment: DOWTHERM A. Am. Petroleum Inst. Toxicol. Rev., 1948. 15p. Contract NObs-65426.

Dowtherm A and biphenyl are essentially pharmacologically inert. Impossibly large doses must be ingested to equal an equivalent LD_{50} dose for rats; 1 ppm in air is readily detectable and 10 ppm untenable for more than a few minutes, but not harmful; slight skin irritation may be experienced on contact. Men have worked in a constant snow of biphenyl for 20 to 30 years with no ill effects. Nothing is known of the toxicity of isopropyl biphenyl. Biphenyl and Santowax R are explosive in air as coal dust, the minimum concentration being 0.035 oz per cu ft. Dry chemical, foam, CO_2, and fog are effective for organic coolant fires, with fog preferred for most installations. (auth)

TRACER APPLICATIONS

66 CEA-497

France. Commissariat à l Energie Atomique, Paris.

CONCEPTION NOUVELLE CONCERNANT L'ETAT DYNAMYQUE DU CHOLESTEROL CHEZ LE RAT (thèse). (New Conception Concerning the Dynamic State of the Cholesterol in the Rat (thesis). Francois Chevallier. 1955. 144p.

Results are reported from a study of the metabolism of cholesterol in rats following the injection of C^{14}-labeled acetate. (99 references.) (In French.) (C.H.)

67 HW-31242

Hanford Atomic Products Operation, Richland, Wash. and Oregon. Univ., Portland. Medical School.

NORMAL ABUNDANCE OF RADIUM IN CADAVERS FROM THE PACIFIC NORTHWEST. R. F. Palmer and F. B. Queen. July 6, 1956. 21p. Contract W-31-109-Eng-52. $0.20(OTS).

68

RADIOACTIVE ISOTOPES IN THE LOCALISATION OF BRAIN TUMOURS. S. Kramer, L. K. Burton, and N. G. Trott (Royal Cancer Hospital and Royal Marsden Hospital, London). Acta Radiol. 46, 415-24(1956) July-Aug.

69

SCANNING OF POSITRON-EMITTING ISOTOPES IN DIAGNOSIS OF INTRACRANIAL AND OTHER LESIONS. G. L. Brownell and W. H. Sweet (Massachusetts General Hospital, Boston). Acta Radiol. 46, 425-34(1956) July-Aug.

70

INFLUENCE OF TEMPERATURE STRESS ON UPTAKE OF P^{32} IN THE RAT. John A. Sealander, Jr. (Univ. of Arkansas, Fayetteville). Am J. Physiol. 186, 227-30 (1956) Aug.

71

C^{14} ISOTOPE EFFECT ON THE ION-EXCHANGE CHROMATOGRAPHY OF AMINO ACIDS. D. A. Piez and Harry Eagle (National Insts. of Health, Bethesda, Md.). J. Am. Chem. Soc. 78, 5284-7(1956) Oct. 20.

The ion-exchange chromatography on Dowex 50 of amino acids labeled with C^{14} was studied. Labeling of the carbon adjacent to an ionized atom, such as the 1- or 2-position in an α-amino acid, resulted in slower movement of the labeled molecules on the column with the result that the specific activity of successive fractions within the amino acid band increased. The presence of the isotope in positions separated from a charged center, such as serine-3-C^{14} and valine-4-C^{14}, had no effect on the ion-exchange behavior. The possibility is discussed that an inductive effect related to the heavier isotope is responsible for the observed differences. (auth)

72

IMMEDIATE AND CONTINUOUS UPTAKE STUDIES OF I^{131} IN THE DIAGNOSIS AND TREATMENT OF HYPERTHYROIDISM. Sol Taplits, Archie Fine, and Lee S. Rosenberg (Jewish Hospital, Cincinnati). Radiology 67, 544-52(1956) Oct.

CHEMISTRY

73 AD-88158

Western Reserve Univ., Cleveland. Inorganic Research Lab.

INORGANIC MACROMOLECULES: SILICON–OXYGEN–TITANIUM SYSTEMS. Technical Report No. 3. Charles A. Brown and Vernon A. Zeitler. Feb. 1, 1956. 49p. Project NR 052-355. Contract Nonr 1439(02).

It has been demonstrated that triphenylsilanol will break a Ti–O–Ti bond. This indicated the greater strength of the Ti–O–Si bond, since tetrakistriphenylsiloxytitanium is the only product of such reactions. This was demonstrated by attempts to prepare hexakistriphenylsiloxydititoxane, from hexabutoxydititoxane, and by hydrolysis of the products resulting from the reaction of triphenylsilanol with butoxychlorotitanium compounds. The infrared spectra of four related compounds have been recorded for the first time and almost complete assignment made for each case. Frequencies in the range 2 to 15 μ have been assigned for the absorption peaks of the Ti–O–Ti bond (820 cm^{-1} and 763 cm^{-1}). (auth)

74 AECU-3326

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

RESEARCH ON THE COMBUSTION AND EXPLOSION HAZARDS OF HYDROGEN–WATER VAPOR–AIR MIXTURES. Progress Report No. 1 [for] March–June 1956. Michael G. Zabetakis. 15p. For Westinghouse Electric Corp. [Atomic Power Div.]

Investigation of the combustion and explosion hazards of H_2–H_2O–air mixtures is initiated. Results of some investigations are reported and recommendations for the power reactor installation at Shippingport, Penna., made. (T.R.H.)

75 AECU-3327

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.

RESEARCH ON THE COMBUSTION AND EXPLOSION HAZARDS OF HYDROGEN–WATER VAPOR–AIR MIXTURES. Final Report. (Report No. 3543). Michael G. Zabetakis. Sept. 4, 1956. 12p. For Westinghouse Electric Corp. [Atomic Power Div.]. $0.20(OTS).

(For preceding period see AECU-3326.) (T.R.H.)

76 LA-2048UNM

New Mexico. Univ., Albuquerque.

THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. VII. p-FLUOROBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. June 1956. 9p. For Los Alamos Scientific Lab. Under Subcontract to [W-7405-eng-36]. $0.15(OTS).

A measurable exchange has been observed in CH_3OH and C_2H_5OH between the iodine atom in p-fluorobenzyl iodide and the iodide ion in potassium iodide. The exchange reac-

tion was investigated over a temperature range from 0 to 30.9°C. The total iodide concentration in CH_3OH and in C_2H_5OH ranged from 0.00148 to 0.0160M and 0.00161 to 0.0122M, respectively. The rate laws for the exchange reaction are $R = 1.07 \times 10^{12}$-exp [−16,300/RT] (p-FBzI) (KI) in CH_3OH and $R = 3.24 \times 10^{12}$-exp [−16,600/RT] (p-FBzI) (KI) in C_2H_5OH, where the units of R are moles × liter^{-1} × min.$^{-1}$. (auth)

77 MCC-1023-TR-196

Ohio State Univ. Research Foundation, Columbus.
THE SOLUBILITY OF HYDROGEN IN DIBORANE. Jih-Heng Hu and George E. MacWood. Jan. 1956. 18p. [For Olin Mathieson Chemical Corp. Contract NOas-52-1023-c].

The solubility of H_2 in liquid diborane was determined in temperature range 113 to 181°K and pressure range 0 to 40 atm. The solubility is found to increase with temperature. The heat of solution at infinite delution ranges from 386 to 601 cal/mol. (auth)

78 NP-6128

Mines Safety Appliances Co., Callery, Penna.
SOLUBILITY OF WATER IN BIPHENYL. Memo Report 113. K. R. Barker and H. E. Cummings. July 5, 1956. 5p. Contract NObs-65426.

In order to determine the solubility of water in biphenyl at various temperatures, biphenyl and water in the ratio of 3:1 were heated in a closed vessel. Samples taken at 200, 300, 400, and 500°F showed the water content of the biphenyl averaged 10 wt. % at 300 and above, but only 0.1 wt. % at 200°F. The higher values are not thought to be true solubility values because of the high probability of mixing of the two phases as later demonstrated in a glass ampule. (auth)

79 NP-6129

Bureau of Mines. Div. of Explosives Technology, Pittsburgh.
EXPLOSIBILITY OF DIPHENYL DUST. Report No. 3489. Irving Hartmann. Dec. 16, 1955. 4p. Project No. 2301-1587.

Experiments were carried out to evaluate the potential dust explosion hazard incident to the handling of diphenyl. Results indicate that dust clouds of biphenyl in air may be ignited readily by hot surfaces, weak electric sparks, and open flames. (W.L.H.)

80 WADC-TR-56-318

Michigan. Univ., Ann Arbor. Engineering Research Inst.
CHEMISTRY OF BORON HYDRIDES AND RELATED HYDRIDES. R. W. Parry, R. C. Taylor, T. C. Bissot, D. H. Campbell, A. E. Emery, P. R. Girardot, G. Kodama, D. R. Schultz, S. G. Shore, and J. T. Yoke, III. Aug. 1956. 186p. Project title: LIQUID PROPELLANTS. Contract AF33(616)-8. (AD-97233).

The types of coordination compounds formed by diborane with various Lewis bases have been explored and the reactions of such coordination compounds have been delineated. The bases studied were: ammonia, methylamine, dimethylamine, trimethylamine, phosphorus trifluoride, nitrogen trifluoride, carbon monoxide, hydroxylamine, N-methylhydroxylamine, N-N dimethyl hydroxylamine, O-methyl hydroxylamine, O,N-dimethyl hydroxylamine, and trimethyl hydroxylamine. The hexammine metal (III) borohydrides have been prepared and it has been shown that the "diammoniate of diborane" has ben structure $[H_2B(NH_3)_2]^+(BH_4)^-$. The decompositions of the borane adducts of the methyl hydroxylamines have been studied in some detail, and mechanistic arguments for the decompositions have been considered. The reduction of phosphorus trichloride by lithium aluminum hydride has been studied. Results of the diborane reaction are interpreted in terms of symmetrical and nonsymmetrical cleavage of the double-bridge bond in diborane. (auth)

81 WADC-TR-56-399

Monsanto Chemical Co. Plastics Div., Springfield, Mass.
POLYMER EVALUATION HANDBOOK. [Period covered] June 1955 to June 1956. C. H. Adams, R. J. Bourke, G. B. Jackson, and J. R. Taylor. June 1956. 118p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3034.

82 AEC-tr-2640

AN INTRODUCTION INTO METHODS OF INVESTIGATION OF THE KINETICS OF ELECTRODE PROCESSES. Heinz Gerischer. Translated from Z. Elektrochem. 59, 604-12(1955). 18p.

Methods for the measurement of the speed of partial processes of an electrode reaction are reported. Topics such as the stationary current voltage curve, the unstationary switch-on processes with constant current, and constant potential are discussed. Examples are given to show how to determine the speed parameters of the essential phase boundary reaction. (J.H.M.)

83 AEC-tr-2642

ON THE EFFECT OF THE ANION ON ELECTRODE POTENTIALS OF METALS IN FUSED SALTS. Yu. K. Delimarskii. Translated from Ukrain. Khim. Zhur. 21, 449-56(1955). 14p.

A scale of electrode potentials has been constructed in fused halides with the aid of the zero-electrode method. Electrode potentials of heavy metals during transition from chlorides to bromide to iodides to fluorides became more negative. The influence of anions on electrode potentials of heavy metals can be explained by the regular change in degree of electrolytic dissociation during transfer from chlorides to iodides, and also by the deformation of ions which occur as a consequence of one-sided or mutual polarization. (W.L.H.)

84 AEC-tr-2649

STUDIES ON NON-METALLIC COMPOUNDS OF ZIRCONIUM AND HAFNIUM. (DIFFERENCES IN THE AFFINITY OF ZIRCONIUM AND HAFNIUM TOWARD NON-METALLIC ELEMENTS). Shizui Fujiwara. Translated from J. Chem. Soc. Japan, Pure Chem. Sect. 71, 580-4(1950). 12p.

In both the nitrogen-added substances and in the raw material metallic Zr, Hf is abundant in the nitride portion and meager in the carbide portion, and conversely, Zr is abundant in the carbide portion. Hf is most abundant in the oxide portion and it decreases in the nitride portion, and is least in the carbide portion. In other words, compared with Zr, Hf has increasing affinity with C, N, and O, in that order, and Zr is in reverse order; here the differences in the affinity of the two elements is seen. This is believed to indicate the fact that compared with Zr, Hf is more strongly basic even in the dry-type reaction, although this may be to only a small extent, and that its bonding force with oxygen is strong. A change from the carbide to the nitride, and from the oxide to the carbide; however, no marked difference in the distribution of Hf between these products and that of the raw materials is seen. Thus, it is believed that dry-type reactions have little to contribute for the concentration and separation of Hf. A high concentration of Hf in the HNO_3-soluble portion is observed. However, the absolute quantity of this portion it extremely small, and it is probably not suitable for practical purposes for the separation of Hf. (auth)

85 AEC-tr-2654

THE ELECTROVISCOUS EFFECT. III. SOLUTIONS OF THORIUM HYDROXIDE. A. Dobry. Translated from J. Chim. phys. 50, 507-11(1953). 14p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-1523.

86 AEC-tr-2657

FREE ENERGIES OF FORMATION IN FUSED SALTS. II. HALIDES OF MANGANESE, COBALT, AND IRON. G. Devoto and A. Guzzi. Translated from Gazz. chim. ital. 59, 591-600(1929). 12p.

The free energies of formation of chlorides, bromides, and iodides of Co and Mn are determined in the molten state along with heats of solution of $MnBr_2$, MnI_2, and CoI_2. The results are discussed from a theoretical point of view. (T.R.H.)

87 AERE-Lib/Trans-729

THE FORMATION OF SPINELS AND SILICATES BY REACTION IN THE SOLID STATE INVESTIGATED BY THE METHOD OF RADIOACTIVE TRACERS. Roland Lindner. Translated by E. L. Poole from Z. Elektrochem. 59, 967-70 (1955). 6p.

Reactions between solid materials at high temperatures and, in particular, the formation of silicates and spinels starting from the oxides do not, according to previous investigations, follow a single mechanism. While the mechanism of a constant rate of diffusion of the two cations in mutually opposing directions within the reacting layer, can be verified for the formation of zinc–iron–spinel, this is not true in the case of some other spinels and silicates. (auth)

88 AERE-Lib/Trans-762

BORON HYDRIDES IX[(1)]. $B_3N_3H_6$. A. Stock and E. Pohland. Translated by F. Hudswell from Ber. deut. chem. Ges. 59, 2215-23(1926). 11p.

The preparation of $B_3N_3H_6$ by various methods is described. Purification, vapor pressure and density, chemical behavior, and molecular structure of $B_3N_3H_6$ are also discussed. (W.L.H.)

89

CYCLOPENTADIENYL-NITRIC OXIDE-DI-SULFUR-MANGANESE. T. S. Piper and G. Wilkinson (Harvard Univ., Cambridge, Mass.). J. Am. Chem. Soc. 78, 900(1956) Mar. 5.

The reaction of S with the compound $(C_5H_5)_3Mn_2(NO)_3$ gives a product with the empirical formula $C_5H_5MnNOS_2$. The properties and structure of this polymeric compound are discussed briefly. (auth)

90

THE RELATIONS OF THORIUM NITRATE AND CERTAIN ORGANIC SOLVENTS. THE COÖRDINATION NUMBER OF Th^{4+}. Leonard I. Katzin, John R. Ferraro, W. W. Wendlandt, and R. L. McBeth (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 78, 5139-44(1956) Oct. 20.

At constant H_2O and $Th(NO_3)_4$ activities (saturated aqueous $Th(NO_3)_4$, the $Th(NO_3)_4$ dissolving in isobutyl alcohol, methyl isobutyl ketone, diethyl ether, ethylene glycol diethyl ether and diethylene glycol diethyl ether is accompanied by 6 to 7 moles of water, and this ratio is not greatly affected by dilution with inert solvent such as carbon tetrachloride. With the dibutyl ethers of ethylene glycol and diethylene glycol the water-thorium ratio is 5. These are consistent with coördination number 8 for the Th^{4+} cation, nitrate ions being partially displaced from the coördination sphere. With tributyl phosphate and dibutyl butylphosphonate the thorium appears essentially without accompanying water, and with 2 to 3 molecules of organic phosphate per thorium. It is demonstrated that the solute is monodisperse, and that there is probably a single bond between the organic component and thorium, which leads to a coördination number less than 8, probably 6. (auth)

91

THE MECHANISM OF THE EXCHANGE REACTION BETWEEN CERIUM(III) AND CERIUM(IV) AT PLATINUM SURFACES. Sture Fronaeus and Carl Otto Ostman (Univ. of Lund, Sweden). Acta Chem. Scand. 10, No. 5, 769-78 (1956).

The heterogeneous electron exchange reaction between Ce^{3+} and Ce^{4+} at Pt surfaces under equilibrium electrode potential is investigated in a perchlorate ionic medium by means of a radioactive tracer. A general relationship for the combination of rates of consecutive steps in exchange reactions is given. From the kinetic law obtained in the present case it is established that at 0°C and in approximately 3M $HClO_4$ the resultant rate of the reaction is controlled both by the electron transfer step and by the diffusion of Ce^{4+} up to the interface. The measurements indicate that the uptake of electrons from platinum by Ce^{4+} takes place via a dimer of Ce^{4+}. Thus this species together with the corresponding mixed $Ce^{3+}-Ce^{4+}$ product, operating in the reverse process, are directly potential adjusting, although the concentrations of both species are very low in comparison with the total concentrations of Ce. The mechanism proposed is discussed in connection with other facts about some homogeneous redox reactions in which Ce is involved. (auth)

92

TITANIUM NITRIDE: ITS PREPARATION AND "HARD-METAL" PROPERTIES. I. C. Kraitzer and I. E. Newnham (C.S.I.R.O., Melbourne, Australia). Australian J. Appl. Sci. 7, 215-23(1956) Sept.

Titanium nitride can be produced from titanium tetrachloride and ammonia by a simple low-cost process. When mixed with suitable alloying elements, titanium nitride powder can be compacted and sintered to give products with typical "hard-metal" properties. Experimental techniques are described and details of the methods used in the chemical analysis of nitride powders and compacts are given. (auth)

93

LIQUID DIFFUSION OF NON-ELECTROLYTES. P. A. Johnson and A. L. Babb (Univ. of Washington, Seattle). Chem. Revs. 56, 387-453(1956) June.

Theoretical and experimental methods are presented on liquid diffusion of nonelectrolytes by a number of investigators. This review is intended to be a source of reference material for information of diffusion phenomena and applied aspects of diffusional processes. (W.L.H.)

94

COLLOIDAL PROPERTIES OF POLONIUM. I. E. Starik, N. I. Alekseenko, and N. G. Rozovskaya (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 755-63(1956) July. (In Russian)

Colloidal properties of Po were studied by methods of vitreous absorption and desorption, by electrochemical separation from copper, and by centrifugation and ultrafiltration of alternating concentrations of Po. The results verified the existence of true Po colloids and established the conditions in which Po can be found in various states. Electrochemical separation of Po permitted an approximate evaluation of the solubility of Po complexes. The values obtained were of relative accuracy but sufficient enough to express the order of magnitude and to explain the formation of colloidal radioelements. The method can be adapted for studies of uranium, ruthenium, radium, etc. (R.V.J.)

95

THE POLONIUM HALIDES. PART III. POLONIUM TETRAIODIDE. K. W. Bagnall, R. W. M. D'Eye, and J. H. Freeman (Atomic Energy Research Establishment, Harwell, Berks, England). J. Chem. Soc., 3385-9(1956) Sept.

Polonium tetraiodide and cesium hexaiodopolonite have been prepared and evidence for the existence of hexaiodo-

polonous acid has been obtained. The crystal structures of the Cs salt and its Te analogue have been determined. (auth)

96

COMPLEX FORMATIONS IN BINARY FUSED SALTS. L. N. Antipin. Uspekhi Khim. 25, 632-42(1956) May. (In Russian)

Studies are made of different electrochemical properties of chlorides LiCl, NaCl, $CaCl_2$, $MgCl_2$, $ScCl_3$, YCl_3, $BeCl_2$, $AlCl_3$, BCl_2, and $SiCl_4$. The process of transitions from solid into liquid state, formation of complex cations and anions, and changes of fused binary salt structure are discussed. (R.V.J.)

97

INVESTIGATIONS OF THE EFFECT OF A SOLVENT ON THE ISOTOPIC EXCHANGE REACTION RATE FOR $C_3H_7I + I^-$ AT 2500 KG/CM^2 PRESSURE. M. G. Gonikberg, V. B. Miller, M. B. Neĭman, F. S. D'yachkovskiĭ, G. I. Likhtenshtein, and A. A. Opekunov (Moscow Inst. of Chemical Physics). Zhur. Fiz. Khim. 30, 784-8(1956) June. (In Russian)

Results of investigation revealed that with the increase of the atmosphere pressure up to 2500 kg/cm^2 the constant for the $C_3H_7I + I^-$ isotopic exchange reaction rate, in alcohol and alcohol–aqueous solutions, more than doubled. In acetone solutions the rate of this reaction under the same pressure was three times slower. Results of kinetic experiments were correlated with measurements of compression for KI solution in alcohol and acetone. (R.V.J.)

98

METHODS FOR DETERMINATION OF THE MECHANISM OF CO–PRECIPITATION OF RADIOELEMENTS WITH THE PRECIPITATIONS OF SLIGHTLY SOLUBLE SALTS. A. P. Ratner. Zhur. Obshcheĭ Khim. 26, 949-51(1956) Apr. (In Russian)

The primary and secondary adsorptions produced by multi-valent ions were differentiated and calculated. The method did not lead to the separate analysis of the primary adsorption from intercrystallization. The relation of the adsorption magnitude to the concentration of its own ions permitted differentiation of various types of adsorptions. (R.V.J.)

99

INTERACTIONS OF HYDROXIDES DURING THEIR FRACTIONAL PRECIPITATION. N. N. Mironov and A. I. Odnosevtsev (Gor'kiĭ State Univ.). Zhur. Obshcheĭ Khim. 26, 960-4(1956) Apr. (In Russian)

Potentiometric titration was used in studies of interactions between hydroxides during their fractional precipitation with ammonia. The systems of $Ti(OH)_4 + Fe(OH)_3$; $Ti(OH)_4 + Al(OH)_3$; $Ti(OH)_4 + Ce(OH)_3$; $Ti(OH)_4 + La(OH)_3$; $Fe(OH)_3 + Al(OH)_3$; $Fe(OH)_3 + Ce(HO)_3$; $Fe(OH)_3 + La(OH)_3$; $Al(OH)_3 + Ce(OH)_3$; $Al(OH)_3 + La(OH)_3$ were investigated. Colloidal formations complicated the separation process. It has been established that basic hydroxides have a stabilizing effect on the colloidal solutions of less basic hydroxides. This was observed very clearly on Fe and Al ions. Formation of colloidal solution is one of the main factors causing the co-precipitation of basic hydroxides with less basic ones. (R.V.J.)

100

RHENIUM REACTION WITH FERROCYANIDES. A. I. Lazarev (Kuĭbyshev Industrial Inst.). Zhur. Obshcheĭ Khim. 26, 965-8(1956) Apr. (In Russian)

Studies indicate that Re ferrocyanide complex contains Re(V). The ratios between the component parts of the complex and the magnitude of molar reduction have been found. The chromotographic ion exchange method was used to reveal the anion character of the colored part of the complex. $H_3[ReO_2(CN)_3Fe]$ is offered as a possible expression of the complex. (R.V.J.)

101

THERMODYNAMIC CHARACTERISTICS OF NaOH, Na_2CO_3, AND Na_2SO_4 AT HIGH TEMPERATURES. D. M. Ginzburg (All Union Inst. of Sodium Industry). Zhur. Obshcheĭ Khim. 26, 968-70(1956) Apr. (In Russian)

102

SPECIFIC HEAT CAPACITY OF Na_2CO_3, Na_2SO_4, AND NaOH AT HIGH TEMPERATURES. M. M. Popov and D. M. Ginzburg. (Moscow State Univ.) Zhur. Obshcheĭ Khim. 26, 971-80(1956) Apr. (In Russian)

ANALYTICAL PROCEDURES

103 CCC-1024-TR-205

Callery Chemical Co., Penna.

DETERMINATION OF BORON IN SOME ORGANOBORON COMPOUNDS. A. J. Krol and K. E. Weber — L. S. Stone, ed. Oct. 15, 1956. 16p. Contract NOa(s)-52-1024-c.

A procedure was developed for accurate and rapid determination of boron in methanol-soluble alkyl hydroxy boranes. The boron-carbon bond is oxidized by H_2O_2 and the boron is distilled as methyl borate from interfering substances. The method is also applicable to alkyl boranes, decaborane, and other methanol-soluble organoboron compounds. Low boron values were obtained for higher boron hydrides and methanol-insoluble samples. Titration curves for some alkyl hydroxy boranes are shown and may be used for qualitative indication of such compounds in the presence of boric acid. (auth)

104 ERI-2228-9-F

Michigan. Univ., Ann Arbor. Engineering Research Inst.

ISOLATION AND DETERMINATION OF SUBMICROGRAM QUANTITIES OF THE HEAVY ELEMENTS FROM GROSS FISSION PRODUCTS. Final Report [for] February 15, 1954 to August 14, 1955. Philip J. Elying and Charles L. Rulfs. Nov. 1955. 15p. Contract AF19(604)-1026. (AFCRC-TR-55-172; AD-86566).

The analytical chemistry of U is reviewed and the results of a search for a simple, fast, method for small amounts of U in fission products are given. (T.R.H.)

105 MD-207

Canada. Dept. of Mines and Technical Surveys, Mines Branch.

THE DETERMINATION OF THE OXYGEN–URANIUM ATOMIC RATIO IN NON-STOICHIOMETRIC URANIUM DIOXIDE, AND OTHER OXIDES OF URANIUM. Norman F. H. Bright, Leonard G. Ripley, John F. Rowland, and Richard H. Lake. July 5, 1956. 37p.

Three methods of determining the O–U atomic ratio in uranium oxides from the stoichiometric compound UO_2, up to non-stoichiometric oxides having the formula $UO_{2.2}$, and also in certain higher oxides of uranium have been evaluated. (auth)

106 NP-6104

Illinois. Univ., Urbana.

FINAL REPORT. PART I. COORDINATION POLYMERS. PART II. RELATIVE RATES OF OXIDATION OF FERROUS SULFATE AND FERROUS AMMONIUM SULFATE SOLUTIONS. PART III. STUDIES ON THE STABILIZATION OF NICKEL (III) THROUGH COORDINATION. John C. Bailar, Jr. and William C. Drinkard, Jr. Aug. 15, 1956. 81p. Part I covers work done under Contract AF33(616)-3209 and Parts II and III cover work done under Contract ONR-07136.

Coordination polymers of copper phthalocyanine have

been shown to form when pyromellitic dianhydride is substituted for phthalic anhydride in the copper phthalocyanine synthesis. Molecular weights have been obtained which range from 1,500 to greater than 20,000. Cobalt and Ni ions also formed phthalocyanine polymers. Polymerization of hydroxyethyl-amine complexes of Co by the reaction of the free hydroxyl groups was not successful due to the extreme inertness of the hydroxyl groups. Inertness is believed to result from the proximity of the hydroxyl groups to the charged Co ion. Ferrous ammonium sulfate, when air was bubbled through 0.1M solutions, oxidized 1.3 times more rapidly than $FeSO_4$. The oxidation rate was proportional to the concentration of $(NH_4)_2SO_4$ in the solution. It is suggested that complexation of Fe^{3+} by the SO_4 was responsible for this acceleration of rate. Attempts to oxidize Ni^{2+} to Ni^{3+} in a series of square planar complexes by Br vapor were unsuccessful. Bromination of the ligand occurred in most cases. Polarographic studies on the effect of electronegativity of coordinated atoms on the shift in half-wave potential of Ni^{2+} were unsuccessful due to adsorption of the ligand to the surface of the electrode. (auth)

107 NP-6120

Stanford Research Inst., Menlo Park, Calif.
CHEMICAL ANALYSIS OF SURFACES BY NUCLEAR METHODS. Final Report. S. Rubin, T. O. Passell, and L. E. Bailey. Sept. 10, 1956. 34p. SRI Project No. SU-1430 and DA Project No. 5B99-01-004. Contract DA-04-200-ORD-440.

Nuclear scattering and nuclear reactions induced by high energy protons and deuterons have been applied to the analysis of solid surfaces. The theory of the scattering method, and analyses of O, Al, Si, S, Ca, Fe, Cu, Ag, Ba, and Pb made by the scattering method are described. Analyses of C, N, O, F, and Na performed using nuclear reactions other than scattering are also described. The methods are applicable to the detection of all elements to a depth of several microns, with sensitivities in the range of 10^{-8} to 10^{-6} gm/cm^2. (auth)

108 UCLA-336

California. Univ., Los Angeles. Atomic Energy Project.
THE PLASMA LIPIDS FOLLOWING X-IRRADIATION. Dorothy L. Fillerup, William H. Slaton, Jr., and James F. Mead. June 8, 1955. 12p. $0.15(OTS).

Chromatographic analysis of the plasma lipids of rats following 800 or 1200 r of x irradiation reveals decreased percentages of triglyceride and free sterol with increased sterol ester and phospholipid as compared with normal fed animals. These changes are not significantly different from those found during a 24 hr fast. Plasma total lipid values varied widely but were within the normal range. (auth)

109 UR-463

Rochester, N. Y. Univ. Atomic Energy Project.
LOW LEVEL POLONIUM DETERMINATION OF TISSUE AND URINE (thesis). Stuart C. Black. Oct. 5, 1956. 124p. Contract W-7401-eng-49. $19.80(ph OTS); $6.30 (mf OTS).

Methods were developed for analysis of up to 50 g of soft tissue and bone and liter volumes of urine for Po content of the order of 1 dpm above background. Bone and lung tissue obtained at autopsy of a uranium miner contained approximately twenty times as much Po as similar material from non-miners. Mice and rats exposed to Rn were analyzed for Po. Calculations gave Po activities of the order of magnitude found by analysis of these animals. The data indicate that approximately 50% of the Po found in mice was in the skeleton, suggesting that it was derived from radiolead stored therein as a result of exposure to Rn approximately 120 days previously. (auth)

110 Y-1143

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.
THE ASSAY OF MICROGRAM SAMPLES OF LITHIUM WITH A MASS SPECTROMETER. Richard E. Sladky. Sept. 8, 1956. 12p. Contract W-7405-eng-26. $0.15(OTS).

As little as 0.6 μg of Li metal as the iodide can be assayed by the procedure presented. An ionization chamber retort for use with liquid samples is described. Special techniques for preparing and assaying the very small samples are discussed, and the precision of the procedure is given. (auth)

111 AERE-Lib/Trans-666

CONTRIBUTIONS TO THE QUALITATIVE MICRO-ANALYSIS OF ACIDS. F. Feigl and P. Krumholz. Translated by F. Hudswell from Mikrochem. Festschr., 77-86(1929). 10p.

Methods are described and reagents discussed for the qualitative micro-analysis of H_3BO_3, CrO_3, H_2SiO_3, and HF. (W.L.H.)

112 AERE-Lib/Trans-753

DETERMINATION OF VERY SMALL AMOUNTS OF URANIUM IN ROCKS AND NATURAL WATERS. F. Hecht, J. Korkisch, R. Patzak, and A. Thiard. Translated by F. Hudswell from Mikrochim. Acta, 1283-1309(1956). 24p.

A method is given for the simple, rapid, and quantitative separation of microgram quantities of uranium from those elements which, following a single ether extraction from nitric acid solution, may enter the extract along with the uranium. In contrast to the other elements concerned, the uranyl ion forms a negatively charged acetate complex in the pH range 4.25 to 5.25. This product is retained by the strongly basic anion exchanger Amberlite I.R.A.-400 (Ac) and can readily be eluted again by means of 0.8N hydrochloric acid. The uranium in the eluate is finally determined by an improved form of the polarographic method announced by Harris and Kolthoff involving the catalytic nitrate wave. A study was made of the characteristics of the polarographic wave of microgram amounts of uranium in nitrate-containing added electrolytes as a function of nitrate, hydrogen, and salt concentrations. After removing all polyvalent cations by means of the ion exchanger Amberlite I.R.A.-400, the findings permitted a rapid and accurate determination of quantities of uranium between 0.1 and 10 μg in rocks and natural waters. On the basis of test solutions and minerals, it was found that the polarographic determination of uranium, following previous accumulation of the uranium by a single extraction with ether and subsequent ion exchange, is more accurate and particularly consumes far less time than the method previously employed which made use of the sodium fluoride bead (after preliminary accumulation of the uranium by extracting twice with ether). 46 references. (auth)

113 TIB/T-4499B

THE CHROMATOGRAPHIC SEMI MICRO-ANALYSIS OF GASES. IV–VI. THE SEPARATION AND ANALYSIS OF GASEOUS HYDROCARBONS. THE ANALYSIS OF INERT GASES. (Chromatographische Halbmikroanalyse von Gasen. IV–VI. Die Trennung und Analyse Gasförmiger Kohlenwasserstoffe. Die Analyse der Edelgase). J. Janak. Translated from Collection Czechoslov. Chem. Communs. 19, 700-11; 917-24(1954). 25p. (AD-92318).

Descriptions are given of the chromatographic separation and analysis of gaseous paraffins, unsaturated C_2 and C_3 hydrocarbons, and cyclopropane, and of apparatus suitable for the procedures. The characteristic elution volumes of He, Ne, A, Kr, and Xe from activated carbon B by CO_2 at 20°C were measured. Their separation from mixtures is discussed. (tr-auth)

114

TITRATION OF MERCURY WITH BIS(2-HYDROXYETHYL) DITHIOCARBAMATE. James S. Fritz and Sally Ann Sutton (Iowa State Coll., Ames). Anal. Chem. 28, 1300-3(1956) Aug.

A direct titrimetric method permits the determination of Hg^{2+} in the presence of chloride, bromide, and numerous metal ions. The Hg is titrated with a standard dithiocarbamate solution in the presence of ethylenediamine tetraacetate and Cu^{2+}. Although most Hg dithiocarbamates are insoluble, formation of a precipitate is avoided by using bis (2-hydroxyethyl)dithiocarbamate as the titrant and acetone-water as the solvent for the mercury. The end point of the titration is indicated by the appearance of a yellow color caused by reaction of the first excess dithiocarbamate with Cu^{2+}. The titration may also be followed potentiometrically using a silver-dithiocarbamate indicator electrode. (auth)

115

THE RAPID SEPARATION AND DETERMINATION OF RADIOSTRONTIUM AND RADIOCAESIUM IN FISSION PRODUCT MIXTURES. J. C. Dalton and G. A. Welch (U. K. Atomic Energy Authority, Cumberland, England). Anal. Chim. Acta 15, 317-19(1956) Oct.

Anion exchange columns in the hydroxide form have been used to remove all fission products from solution except Sr and Cs (assuming Ba absent). These two elements have been determined in the eluate by precipitation of oxalate and perchlorate respectively. The resulting procedure has been found to be more precise and quicker than others previously used. (auth)

116

THE DETERMINATION OF OXYGEN IN TITANIUM. VACUUM FUSION WITH A PLATINUM BATH. Donald H. Wilkins and James F. Fleischer (General Electric Co., Schenectady, N. Y.). Anal. Chim. Acta 15, 334-6(1956) Oct.

Oxygen can be determined in titanium accurately by vacuum fusion with a platinum bath. The platinum bath is preferred to an iron bath or dry bath since more samples can be analyzed in a bath without interference from gettering and solidification of the bath. The blank from adding iron or tin with the sample is eliminated. (auth)

117

SPECTROPHOTOMETRIC DETERMINATION OF RARE EARTH MIXTURES. Charles V. Banks and Donn W. Klingman (Iowa State Coll., Ames). Anal. Chim. Acta 15, 356-63(1956) Oct.

The molar absorptivities for most of the rare earths have been determined at the wavelengths of the various analytically significant absorption bands. These molar absorptivities have been determined on the Beckman Model DU spectrophotometer with and without a photomultiplier attachment as well as on a Cary Model 14 recording spectrophotometer. The techniques and instrumentation necessary for the satisfactory analysis of rare earth mixtures are discussed. A general procedure is presented which has been found most useful for the routine analysis of a wide variety of rare earth mixtures. (auth)

118

DIPHENYLCARBAZONE AS AN INTERNAL INDICATOR IN VOLUMETRIC ANALYSIS. III. VOLUMETRIC DETERMINATION OF THORIUM BY AMMONIUM MOLYBDATE. G. S. Deshmukh and Indumati Bokil. Bull. Chem. Soc. Japan 29, 449-50(1956) June.

A simple volumetric method for the quantitative estimation of thorium as molybdate is described. This is based on the titration of aqueous thorium nitrate (or chloride) solution against standard ammonium molybdate in presence of ethanol by using diphenylcarbazone as the internal indicator. Under specified operative conditions, normal thorium molybdate is precipitated. The indicator behaves reversibly and the accuracy of the method is comparable with those obtained by classical procedures. (auth)

119

SPECTROPHOTOMETRIC DETERMINATION OF MICRO QUANTITIES OF TITANIUM WITH 8-HYDROXYQUINALDINE. Kenji Motojima (Ritsumeikan Univ., Kyoto, Japan). Bull. Chem. Soc. Japan 29, 455-8(1956) June.

The spectrophotometric method for determination of micro quantities of titanium with 8-hydroxyquinaldine was established. By this method from 3 to 50 micrograms of itanium in about 35 ml. of solution can be determined; therefore the sensitivity of this method is almost equal to that of the tiron method established by Yoe and his coworker, but is much better than that of the ordinary hydrogen peroxide method. A few milligrams of aluminum do not interfere with this method. The method for simultaneous determination of micro quantities of titanium and iron was studied. (auth)

120

SPECTROPHOTOMETRIC DETERMINATION OF MICRO QUANTITIES OF IRON, TITANIUM, AND ALUMINUM WHEN THEY ACCOMPANY EACH OTHER. USE OF 8-HYDROXYQUINALDINE AND OXINE. Kenji Motojima and Hiroshi Hashitani (Ritsumeikan Univ., Kyoto, Japan). Bull. Chem. Soc. Japan 29, 458-60(1956) June.

The method for separation and spectrophotometric determination of micro quantities of iron, titanium and aluminum with 8-hydroxyquinaldine and oxine was established. By this method, from 3 to 50 micrograms of iron, titanium and aluminum mixed in about 35 ml. of solution, are determined, rapidly and accurately. (auth)

121

THE SEPARATION OF LITHIUM FROM ALKALI METAL IONS. Gerald A. Guier and George S. Hammond (Iowa State Coll., Ames). J. Am. Chem. Soc. 78, 5166-7(1956) Oct. 20.

It has been found that dipivaloylmethane, DPM, binds Li ions selectively and firmly under alkaline conditions. By use of an ether solution of the reagent as an extractant, it is possible to determine Li in the presence of the other alkali metals. A small correction is necessary if large amounts of Na are present. (auth)

122

RAPID ANALYSIS OF REACTION MIXTURES BY NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY. Norbert Muller and Jerome Goldenson (Chemical Warfare Labs., Army Chemical Center, Md.). J. Am. Chem. Soc. 78, 5182-3(1956) Oct. 20.

Nuclear magnetic resonance spectroscopy is found to be a highly effective tool for the analysis of certain reaction mixtures involving phosphorus compounds. This is shown by the application of this technique to the isomerization of the insecticide β-ethylmercaptoethyl diethyl thionophosphate (Systox). Results indicate that the rate law for the isomerization is intermediate between zero and first order, probably indicating a catalytic effect. (auth)

123

THE BERYLLON I AND II AS NEW REAGENTS FOR COLORIMETRIC DETERMINATION OF BERYLLIUM. A. M. Lukin and G. B. Zavarikhina (Moscow All Union Research Inst. of Chemical Reagents). Zhur. Anal. Khim. 11, 393-9(1956) July-Aug. (In Russian)

A new reagent for Be in a field of azo dyes, containing chromotropic acid residue has been found. Ten dyes with amino substituted by derivatives of benzene, three of naphthalene and one of antraquinone have been prepared. The diazo-H-acid proved to be the most advantageous reagent for Be. It is stable in alkaline media, very soluble in water, and has the sensitivity limit of 0.2 γ Be in 5 ml

at pH 12 to 13. Its use in conjunction with trelon B, makes it more selective as a reagent for Be. (R.V.J.)

124

COLORIMETRIC DETERMINATION OF BERYLLIUM BY MEANS OF NEW REAGENTS-BERYLLON. G. G. Koranovich (Moscow All Union Research Inst. of Chemical Reagents). Zhur. Anal. Khim 11, 400-4(1956) July-Aug. (In Russian)

Investigations of Beryllon II revealed its indicator properties and its characteristic color changing from red to violet at pH ~ 9.2 to 10.6. The optimum color effect with Be was at pH ~ 12 to 13.2, and the sensitivity limit about 0.2 γ in 5 ml of the solution. The procedures and conditions have been developed for determination of Be in the presence of Fe^{3+}, Co, Ni, Cu, Al, Mg, and Ca. (R.V.J.)

125

DETECTION OF BERYLLIUM IONS. V. K. Zolotukhin (L'vov State Univ.). Zhur. Anal. Khim. 11, 508-9(1956) July-Aug. (In Russian)

The method is based on the interaction of $Be(OH)_2$ with fluorides of alkali metals and the formation of OH ions which induce red coloration of phenolphthalein. The limit of dilution is 1: 2,500,000, and the possible detection minimum is 0.4 γ Be in 1 ml of solutions. The Be must be separated from other ions. (tr-auth)

126

ISOTOPIC ANALYSIS OF Ca, Sr, AND Ba WITH THE AID OF ALUMINUM ION EMITTER. P. A. Akishin, G. M. Panchenkov, N. N. Vasil'ev, and O. T. Nikitin (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 30, 1387-91(1956) June. (In Russian)

A new method is given for the spectroscopic analysis of Ca, Sr, and Ba isotopes using a synthetic alumino-silicate ion exchanger as an ion emitter. It is activated by Zr oxychloride solution and saturated with the cation of the element under investigation. (tr-auth)

127

DETERMINATION OF THE OXYGEN ISOTOPIC CONTENT IN ORGANIC COMPOUNDS. R. V. Kudryavtsev, B. V. Ottesen, and D. N. Kursanov. Zhur. Obshcheĭ Khim. 26, 1035-9(1956) Apr. (In Russian)

Methods of determination of O in organic compounds by an exhaustive hydration over a nickel-frame catalyzer, followed by mass-spectrometric analysis are described. (R.V.J.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

128 NP-6127

Saint Louis Univ.

SEMICONDUCTING PROPERTIES OF BORON. Final Technical Report for Period October 16, 1952 to September 15, 1956. Vincent P. Jacobsmeyer. Oct. 15, 1955. 34p. DA Project No. 5B99-01-004. Contracts DA-23-072-ORD-471 and DA-23-072-ORD-585.

The research performed to study the recrystallization processes and the single crystal growth in B, and to construct an a-c apparatus for measuring the Hall effect in B is discussed in detail. (J.H.M.)

129

THE STUDY OF EPITAXY IN THIN SURFACE FILMS. D. W. Pashley (Imperial Coll., London). Advances in Phys. 5, 173-240(1956) Apr.

An account is given of the electron diffraction evidence concerning the formation of an oriented growth of one crystal upon an other, and the relation of this evidence to existing theories. A discussion of the uses and limitations of electron diffraction as a technique in such studies is presented. (W.L.H.)

130

LOWER OXIDES OF SAMARIUM AND EUROPIUM. THE PREPARATION AND CRYSTAL STRUCTURE OF $SmO_{0.4-0.6}$, SmO and EuO. H. A. Eick, N. C. Baenziger, and L. Eyring (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 78, 5147-9(1956) Oct. 20.

A lower oxide of samarium whose oxygen to samarium ratio varied between 0.4 and 0.6 was prepared. This compound has the face centered cubic zinc blende-type structure; the lattice parameter varies between 5.3698 ± 0.0006 and 5.3790 ± 0.0008A. The lattice parameter of SmO is 4.9883 ± 0.0003 A. Previously reported variations in the lattice parameter of SmO are believed to be due to nitride–oxide mixtures. EuO has a NaCl-type structure with a lattice parameter of 5.1439 ± 0.0005. A. (auth)

131

SPECTRA AND STRUCTURES OF METAL-CARBON MONOXIDE COMPOUNDS. II. MANGANESE AND RHENIUM DECACARBONYLS. F. Albert Cotton, Andrew Liehr, and Geoffrey Wilkinson (Harvard Univ., Cambridge, Mass.). J. Inorg. and Nuclear Chem. 2, 141-8(1956) Mar.

The infra-red absorption spectra of $Mn_2(CO)_{10}$ and $Re_2(CO)_{10}$ have been measured from 450 to 3000 cm^{-1} in the solid, in solution, and in the gas phase. The spectra are interpreted according to a method of local symmetry, and two possible structures, both involving a pseudo-ring of carbon monoxide ligands lying between the metal atoms, are suggested. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

132 AECD-3754

Columbia Univ., New York. Div. of War Research.

PRELIMINARY REPORT ON HIGH CONCENTRATION OF DEUTERIUM BY CATALYTIC EXCHANGE REACTIONS. Harris Mayer and Robert Bonner. Feb. 4, 1943. Decl. Aug. 14, 1956. 21p. Project DSM. Contract OEMsr-412. (4-R-19). $4.80(ph OTS); $2.70(mf OTS).

The theoretical analysis of a plant to concentrate D_2 from 2 at. % to 90 at. % by the NH_3-H_2 exchange reaction is presented. (T.R.H.)

133 NBS-4712

National Bureau of Standards, Washington, D. C.

A REVIEW OF THE REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. VI. SOLVOLYSIS REACTIONS. Lawrence M. Brown. July 15, 1956. Project 0302-10-2641. $0.20(OTS).

A review of the literature on the kinetics of solvolysis reactions of deuterium and tritium compounds has been prepared for the period, 1932 to 1955. The experimental data are summarized in four tables. Twenty-three references are cited. (auth)

134

DEUTERIUM ATOM REACTIONS WITH ALKENES. THE RELATION OF METHANE DEUTERIZATION TO DEUTERIUM ATOM CONCENTRATIONS IN THE SYSTEM. R. E. Mardaleĭshvili, G. B. Pariĭskiĭ, V. A. Poltorak, and V. V. Voevodskiĭ (Lomonosov Moscow State Univ.). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk 516-24(1956) May. (In Russian)

Tabulations are given for methane deuterization in the (D + D_2) RH system with various D-atom concentrations. Mass spectrometric analysis was used to obtain the quantitative data to confirm the theory of free radical exchange with molecular deuterium. It has been shown that deuterium atoms do not participate actively in free radical exchange. In combination of hydrogen atoms (H or D) with alkenes, radicals of both possible types are formed. (R.V.J.)

135

MILLIMETER-WAVE LINES OF HEAVY WATER. Gunnar Erlandsson and John Cox (Duke Univ., Durham, N. C.). J. Chem. Phys. 25, 778-9(1956) Oct.

The lines $1_{1,1} \rightarrow 1_{1,0}$ and $2_{1,2} \rightarrow 2_{1,1}$ for HDO are observed at 80,578.15 Mc and 241,561.3 Mc, respectively. Other transitions are also reported. (T.R.H.)

136

HYDROGEN ISOTOPE EXCHANGE. D. R. Augood (E. I. du Pont de Nemours and Co., Inc., Orange, Tex.). Nature 178, 754-5(1956) Oct. 6.

The derivation and application of relationships involving the separation factor for H_2 and D_2 exchange processes are given. (T.R.H.)

137

THE CATALYSIS OF H_2-D_2 EXCHANGE BY OXIDES. D. A. Dowden and N. Mackenzie (Imperial Chemical Industries, Billingham, England) and B. M. W. Trapnell (Liverpool Univ., England). Proc. Roy. Soc. (London) A237, 245-54(1956) Oct. 9.

Hydrogen–deuterium exchange was investigated at the surfaces of 13 oxides of the first transition period, at temperatures between –195 and 20°C and pressures between 1 and 5 cm. There appears to be a simple correlation between the catalytic activity per unit surface area and the electronic configuration of the metal ion. The condition for high activity is that the oxide should possess some but not too many unpaired d-electrons. Thus, high activity occurs just after the beginning of the period (Cr_2O_3) and towards the end (Co_3O_4 and NiO). If there are no unpaired d-electrons (TiO_2, V_2O_5, Cu_2O, ZnO, Ga_2O_3, GeO_2) or very few (V_2O_3, CuO) or very many (MnO, Fe_2O_3) the activity is low. A tentative explanation of the results is offered, mainly in terms of the influence of electronic configuration on the velocity of hydrogen chemisorption. The results suggest that hydrogen behaves similarly at metal and at oxide surfaces, giving catalysis by these solids a common motif. There is no simple correlation with oxides between exchange activity and semi-conductivity. Pressure dependences of the exchange velocity have been measured for Cr_2O_3, NiO, ZnO, and Ga_2O_3; these throw some light on the question of the exchange mechanism. (auth)

138

METHOD FOR INVESTIGATION OF HYDROGEN ISOTOPIC EXCHANGE IN LIQUID DEUTERIUM BROMIDE. V. R. Kalinachenko, Ya. M. Varshavskiĭ, and A. I. Shatenshteĭn. (Karpov Moscow Physico-Chemical Inst.). Zhur. Fiz. Khim. 30, 1140-3(1956) May. (In Russian)

Descriptions are given of an apparatus for the preparation and isotopic analysis of DBr, and of the procedure for investigating the isotopic exchange of H between organic compounds and liquid hydrogen bromide. (tr-auth)

139

EVALUATION OF EXPERIMENTAL DATA ON HYDROGEN ISOTOPE EXCHANGE. Ya. M. Varshavskiĭ and V. R. Kalinachenko (Karpov, Moscow Physico-Chemical Inst.). Zhur. Fiz. Khim. 30, 1376-9(1956) June. (In Russian)

General equations, based on experimental data, have been derived for calculations of deuterium distribution coefficient and for determination of exchangeable and exchanged hydrogen atoms considering the different exchange capacities for different hydrogen atoms in the molecule and the possibility of deviation of deuterium distribution coefficients from unity. (tr-auth)

140

DETERMINATION OF THE DISTRIBUTION COEFFICIENT OF DEUTERIUM IN ISOTOPIC HYDROGEN EXCHANGE BETWEEN NAPHTHALENE AND DEUTERIUM BROMIDE. Ya. M. Varshavskiĭ, V. R. Kalinachenko, S. E. Vaĭsberg, and A. I. Shatenshteĭn (Karpov Moscow Inst. of Physical Chemistry). Zhur. Fiz. Khim. 30, 1647-51(1956) July. (In Russian)

The distribution coefficient of deuterium in the isotopic hydrogen exchange between naphthalene and deuterium bromide has been determined over the temperature of 0 to 70°. The values of α obtained (3.1 at 0°; 3.0 at 20°; 2.8 at 25°; 2.6 at 50°; and 2.4 at 70°C) are close to those calculated from the theoretically derived expression $\alpha = 0.574_e^{467.4/T}$. (auth)

141

THE CASCADING PROBLEM IN A WATER DISTILLATION PLANT FOR HEAVY WATER PRODUCTION. E. Cerrai, M. Silvestri, and S. Villani (Laboratori CISE, Milan, Italy). Z. Naturforsch. 11a, 694-701(1956) Sept. (In English)

A criterion for the designing of minimum specific volume cascades is generalized to be applicable in the case of large enrichments of the stages. The practical solution of the cascading problem is also described for a water distillation plant for heavy water production which is supposed to use geothermal steam from the Larderello zone (Tuscany), taking into account the variability of the separation factor within the columns, due to the pressure drop. (auth)

FLUORINE AND FLUORINE COMPOUNDS

142 KY-191

Union Carbide Nuclear Co. Paducah Plant, Ky.
MATERIALS FOR FLUORINE GENERATOR ANODE ASSEMBLIES. R. E. Simmons, W. R. Rossmassler, C. W. Hoskins, and R. A. Johnston. Sept. 28, 1956. 13p. Contract [W-7405-eng-26]. $0.20(OTS).

Corrosion of anode assembly materials in F_2 generators is pronounced, therefore, selection of the proper materials of construction is important. Several metals and alloys have been tested for corrosion resistance when anodic in a F_2 test cell. The relative corrosion resistance of most of the materials has been determined by three methods. The current-voltage method is the most rapid and, generally, is verified by the other two methods. By this method, current-voltage curves are obtained for the material under test. The corrosion is proportional to the current, therefore, the relative corrosion rate as a function of the voltage may be obtained by referring to the curve. In general, Cu, Cu alloys and Mg alloys offer the best corrosion resistance. The resistance of Cu is improved by alloying with Zn, P, Sn, Be and Al, but Pb and Si have the opposite effect. The resistance of mild steel is little changed by addition of alloying elements. High Ni alloys, Pb, Al and cast iron were severely corroded. Several materials which offer good corrosion resistance at low voltages (i.e. 10 volts) were badly pitted at voltages above the breakdown voltage. (auth)

143 MLCR-12

Hazelton Labs., Falls Church, Va.
CHLORINE TRIFLUORIDE. Nellie Perry Watts. Sept. 15, 1952. 31p. Project 4-61-14-002. Contract DA-18-108-CML-4399. (AD-1779; U-25934).

The preparation and properties of ClF_3 are outlined along with an annotated bibliography. (T.R.H.)

144 NP-6110

Peninsular ChemResearch, Inc., Gainesville, Fla.
DEVELOPMENT OF FLUORO-SILICONE ELASTOMERS. Progress Report for the Period March 15–June 15, 1956. (Report No. 56-2). George W. Dyckes. June 15, 1956. 39p. Project title: RUBBER, PLASTICS AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3238.

Progress is reported in the preparation of $CF_3CF_2(CH_2)_2SiCl_3$. The reaction of HF with $CF_2Br(CH_2)_2Br$

was studied and improved yields of $CF_3(CH_2)_2Br$ obtained. The monomers $CF_3CF_2(CH_2)_2Si(CH_3)Cl_2$ and $CF_3CF_2CF_2(CH_2)_2Si(CH_3)$ were hydrolyzed and the constant boiling fractions characterized. (T.R.H.)

145

THE STABILITY OF METAL HALIDE COMPLEXES IN AQUEOUS SOLUTION. I. THE STABILITY OF METAL HALIDE COMPLEXES IN RELATION TO THE POSITION OF THE METAL IN THE PERIODIC SYSTEM. Sten Ahrland (Univ. of Lund, Sweden). Acta Chem. Scand. 10, No. 5, 723-6(1956).

With respect to the strength of their halide complexes central ions may be divided into two groups. The first group shows decreasing stability in the order $F^- \gg Cl^- > Br^- > I^-$, the second one in the reversed order $F^- \ll Cl^- < Br^- < I^-$. The extension of the two groups within the Periodic System is discussed. (auth)

146

THE STABILITY OF METAL HALIDE COMPLEXES IN AQUEOUS SOLUTION. II. THE FLUORIDE COMPLEXES OF DIVALENT NICKEL, COPPER, AND ZINC. Sten Ahrland and Kjell Rosengren (Univ. of Lund, Sweden). Acta Chem. Scand. 10, No. 5, 727-34(1956).

The stabilities of the fluoride complexes of Ni^{2+}, Cu^{2+}, and Zn^{2+} have been determined. In the solutions studied ($[F^-] \leq .200M$; $C_M \leq .100M$; perchlorate medium of ionic strength 1M at 20°C) only the first mononuclear complex exists in appreciable concentrations. The following values of the constant $\beta_1 = [MF^+]/[M^{2+}]\,[F^-]$ have been found: Ni^{2+}: 4.6 ± 0.5/M; Cu^{2+}: 9 ± 1/M; Zn^{2+}: 5.9 ± 0.6/M. The stability order of these complexes, as well as their strength relative to the complexes formed by the same metal ions with the other halide ions is in accordance with the views previously advanced. (auth)

147

LUMINESCENCE OF THE DYE CENTERS IN FLUORIDE CRYSTALS. G. A. Tishchenko and P. P. Feofilov. Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 482-7(1956) Apr. (In Russian)

Investigations of the absorption band structures and the luminescence of dye centers were made on prepared CaF_2 crystals. The nature of the multiplicity of the elementary emitters in the investigated dye centers was determined on luminescence polarization diagrams. The position of the bands in crystals of CaF_2 (d = 2.36, d is the constant lattice, λ_{max} = 560mμ); in LiF (d = 2.01, λ_{max} = 445mμ); and NaF(d = 2.31, λ_{max} = 510mμ). In salts with complex dye centers as LiCl (d = 2.57) luminescence maximum should be near 810 mμ and for LiBr (d = 2.75) and CsI (d = 3.66) even larger wave of luminescence should be expected. The λ_{max} for BaF_2 is expected to be near 880mμ. (R.V.J.)

148

ABSORPTION AND LUMINESCENCE OF FLUORIDE SOLUTIONS OF LEAD AND THALLIUM. M. U. Belyi and A. A. Shishlovskii (Shevchenko Kiev State Univ.). Izvest. Akad. Nauk S S.S.R. Ser. Fiz. 20, 574-8(1956) May. (In Russian)

Absorption properties of $Pb(ClO_4)_2$ + KF mixed solutions with changing concentrations of KF were studied. With small concentration of F^- (up to 1.41 mol. l^{-1}) the absorption spectrum of Pb^{2+} hydrate cation kept diminishing and slightly spreading; with increased F^- content, the band position (λ_{max} = 208.5 mμ) and its intensity remained constant until the fluoride ion concentration reached 4.1 mol. l^{-1}. The absorption spectrum began to grow reaching its maximum with the maximum concentration of fluorine ions. A glow of violet luminescence was observed in solutions activated by high concentrations of F^- and a new complex PbF^+ was found. Fluorine solutions with Tl produced an opposite effect. With strong F^- concentrations the luminescence of Tl was deactivated and the state of excitation was reduced, indicating the absence of stable complexes of Tl with F. (R.V.J.)

149

IONIC MOBILITIES IN ANHYDROUS HYDROFLUORIC ACID. Martin Kilpatrick and T. J. Lewis (Illinois Inst. of Tech., Chicago). J. Am. Chem. Soc. 78, 5186-9(1956) Oct. 20.

Conductance and transference number measurements in anhydrous HF are described, and several ionic mobilities are tabulated. The mechanism of electrical conductance in this solvent is discussed. (auth)

150

THE FLUORINATION OF TELLURIUM. DITELLURIUM DECAFLUORIDE AND TELLURIUM OXYFLUORIDES. R. Campbell and P. L. Robinson (King's Coll., Newcastle upon Tyne, England). J. Chem. Soc., 3454-8(1956) Sept.

The action of F on Te gives at ~150° exclusively the hexafluoride, at ~60° hexafluoride and some Te_2F_{10}, and at ~0° mainly tetrafluoride. The proportion of decafluoride is increased by various solid additives; of these TeO_2 was the most effective. Apart from the useful control of temperature brought about by diluting the F_2 with another gas, a gaseous diluent also raises the yield, N_2 considerably and O_2 much more. With the use of the former the oxyfluoride $Te_3F_{14}O_2$ also appears among the products, and with the latter both this oxyfluoride and a more complex one are formed. The Te_2F_{10} has been rigorously purified and many of its properties have been studied. Our data are in substantial agreement with those of others. The properties of $Te_3F_{14}O_2$ and the material of higher molecular weight, possibly $Te_6F_{26}O_5$, are described. (auth)

151

NEW VARIABLE THICKNESS INFRARED CELL AND THE INFRARED SPECTRA OF HF, DF, H_2O, AND D_2O. Richard M. Adams and J. J. Katz (Argonne National Lab., Lemont, Ill.). J. Opt. Soc. Amer. 46, 895-8(1956) Oct.

A new variable thickness infrared cell which may be used for corrosive liquids such as HF or for aqueous solutions is described. The cell is constructed of Monel metal with silver chloride windows, and is variable from a few microns up to about three quarters of a millimeter in thickness. The infrared spectra of liquid HF, DF, H_2O and D_2O are given along with the absorption coefficients for the principal peaks. (auth)

152

ANALYSIS OF BORON FLUORIDE ISOTOPES BY MASS SPECTROSCOPY. G. M. Panchenkov and V. D. Moiseev (Lomonosov Moscow State Univ.). Zhur. Fiz. Khim. 30, 1118-25(1956) May. (In Russian)

Mass spectrometric determination of BF_3 isotopic composition was complicated by the strong BF_3 adsorption in the apparatus with a resultant isotopic effect on desorption of the gas during evacuation. A description is given of a measurement method considering the BF_3 behavior in the mass spectrometer. The content of B^{10} in BF_3 was determined with 0.5% accuracy, with the B^{10} content nearly 20%. (tr-auth).

GRAPHITE

153 AECD-3755

Great Lakes Carbon Corp., Morton Grove, Ill.

QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1951. L. H. Juel. Decl. June 12, 1956. 17p. Contract AT[11-1]-172. $4.80(ph OTS); $2.70(mf OTS).

An investigation was made of the preparation of self-purifying raw materials for use in the production of graphite bars for atomic reactors. The general objectives of the study included the development of an improved

purification process for carbon bars through the use of such purifying agents as CF_4, SF_6, and Cl_2; the development of methods for determination of the purity of graphite; and the development of a simplified purification process through the use of self-purifying raw materials or by purification of the raw materials prior to processing into graphite bars. The building and equipment are illustrated photographically. Laboratory investigations were made of conditions necessary to produce chlorocake containing a sufficient amount of chlorine to theoretically volatilize the ash constituents present therein. Problems of chlorine retention in the purified graphite are discussed. (C.H.)

154 AECD-3756
Great Lakes Carbon Corp., Morton Grove, Ill.
QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1951. L. H. Juel. Decl. June 12, 1956. 27p. Contract AT(11-1)-172. $4.80(ph OTS); $2.70(mf OTS).

155 AECD-3757
Great Lakes Carbon Corp., Morton Grove, Ill.
QUARTERLY REPORT [FOR] JANUARY, FEBRUARY, MARCH 1952. L. H. Juel. Decl. June 12, 1956. 27p. Contract AT(11-1)-172. $4.80(ph OTS); $2.70(mf OTS).

156 COO-136
Great Lakes Carbon Corp., Morton Grove, Ill.
[QUARTERLY] REPORT [FOR] DECEMBER 1952 THROUGH FEBRUARY 1953. L. H. Juel. Decl. June 12, 1956. 20p. Contract AT(11-1)-221. $4.80(ph OTS); $2.70(mf OTS).

157 COO-138
Great Lakes Carbon Corp., Morton Grove, Ill.
QUARTERLY REPORT [FOR] JUNE, JULY, AUGUST 1953. E. C. Thomas. Oct. 2, 1953. Decl. June 12, 1956. 9p. Contract AT(11-1)-221. $3.30(ph OTS); $2.40(mf OTS).

158 COO-139
Great Lakes Carbon Corp., Morton Grove, Ill.
QUARTERLY REPORT [FOR] SEPTEMBER, OCTOBER, NOVEMBER 1953. M. W. Nathans. Jan. 22, 1954. Decl. June 12, 1956. 17p. Contract AT(11-1)-221. $3.30(ph OTS); $2.40(mf OTS).

159 COO-201
Great Lakes Carbon Corp., Morton Grove, Ill.
QUARTERLY REPORT [FOR] DECEMBER 1953, JANUARY, FEBRUARY 1954. M. W. Nathans. Decl. June 12, 1956. 22p. Contract AT(11-1)-211. $4.80 (ph OTS); $2.70(mf OTS).

160 RAE-R-MET-87
Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.
PREPARATION AND PROPERTIES OF HIGH TEMPERATURE PYROLYTIC CARBON. A. R. G. Brown. June 1955. 59p. (AD-79083).

A method for preparing massive specimens of carbon by the breakdown of hydrocarbon gases at various temperatures and sub-atmospheric pressures is described. The rate of deposition, density, electrical resistivity and thermal conductivity of the deposits are found to be dependent on temperature of deposition. For deposits produced at 1800°C the density is 1.35 g/cm^3, the electrical resistivity 2200×10^{-6} ohm cms, and thermal conductivity 0.06 g cal cm/cm^2 °C sec; the corresponding values for material formed at 2100°C are 2.23 g/cm^3, 200×10^{-6} ohm cms, and 1.3 g cal cm/cm^2 °C sec. The structure of the deposits is of layer planes of hexagonally arranged carbon atoms lying parallel to the surface of the original substrate, but otherwise randomly oriented. (auth)

161
ENERGY OF COHESION, COMPRESSIBILITY, AND THE POTENTIAL ENERGY FUNCTIONS OF THE GRAPHITE SYSTEM. L. A. Girifalco and R. A. Lad (Lewis Flight Propulsion Lab., Cleveland, Ohio). J. Chem. Phys. 25, 693-7(1956) Oct.

The lattice summations of the potential energy of importance in the graphite system have been computed by direct summation assuming a Lennard-Jones 6-12 potential between carbon atoms. From these summations potential energy curves were constructed for interactions between a carbon atom and a graphite monolayer, between a carbon atom and a graphite surface, between a graphite monolayer and a semi-infinite graphite crystal and between two graphite semi-infinite crystals. Using these curves, the equilibrium distance between two isolated physically interacting carbon atoms was found to be 2.70 a, where a is the carbon-carbon distance in a graphite sheet. The distance between a surface plane and the rest of the crystal was found to be 1.7% greater than the interlayer spacing. Theoretical values of the energy of cohesion and the compressibility were calculated from the potential curve for the interaction between two semi-infinite crystals. They were $\Delta E_c = -330$ ergs/cm^2 and $\beta = 3.18 \times 10^{-12}$ cm^2/dyne, respectively. These compared favorably with the experimental values of $\Delta E_c = -260$ ergs/cm^2 and $\beta = 2.97 \times 10^{-2}$ cm^2/dyne. (auth)

162
MEASUREMENT OF NEUTRON TEMPERATURE IN GRAPHITE. M. Küchle. Z. Naturforsch. 11a, 676-7(1956) Aug. (In German)

LABORATORIES AND EQUIPMENT

163
PRECIOUS-METAL-COATED BOMBS FOR HIGH-TEMPERATURE STUDIES. R. M. Bidwell, W. R. Wykoff, B. J. Thamer, and C. D. Ross (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 10, 71-7(1956) Oct.

Designs of several different types of high-temperature and pressure bombs are presented. Ways are presented for coating the inside of these bombs with precious metals. (W.L.H.)

MOLECULAR STRUCTURE

164 UCRL-3491
California. Univ., Berkeley. Radiation Lab.
BONDING IN COPPER (II) CHELATES: SOLVENT EFFECTS IN THEIR VISIBLE ABSORPTION SPECTRA. R. Linn Belford, M. Calvin, and Geneva Belford. Sept. 1956. 33p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00 (mf OTS).

Absorption spectra, in the visible red and near infrared, are reported for solutions of bis-acetylacetone-Cu^{2+} and its 3-ethyl variant in various media. The spectra could arise from a set of three Gaussian components whose positions and intensities are shown to depend primarily upon solvent basicity. These component bands are identified with three $3d^1 \rightarrow 3d^1$ transitions predicted from crystal field and molecular orbital theories. The behavior of these bands upon alteration of solvent and of chelate ring substituents appears consistent with the postulate that pi-bonding changes are energetically of less importance than changes in crystal field splitting and in sigma bonding. (auth)

165 AEC-tr-2650
THEORY OF LIGHT ABSORPTION OF COMPLEX COM-

POUNDS. A. Kiss. Translated from Z. anorg. u. allgem. Chem. 282, 141-8(1955). 12p.

RADIATION CHEMISTRY

166 WAPD-TM-12

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RADIATION-INDUCED REDUCTION OF CHROMIUM(VI) SOLUTIONS. H. A. Droll and W. T. Lindsay, Jr. Aug. 1956. 22p. Contract AT-11-1-GEN-14. $0.20(OTS).

Alkali metal chromate solutions are being considered as corrosion inhibitors in the PWR neutron shield tank. Both CrO_4^- and $Cr_2O_7^{2-}$ are reduced by γ radiation in the conditions of the test, the rate for $Cr_2O_7^{2-}$ being greater. However, a chromate inhibitor solution [0.005 gram atoms/l of Cr^{6+}] at pH 8.5 to 9.0 is eminently satisfactory for shielding applications. (T.R.H.)

167

THE RADIATION INDUCED DECOMPOSITION OF FERROUS AMMONIUM SULFATE. Everett R. Johnson (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 78, 5196-7 (1956) Oct. 20.

The radiation induced decomposition of ferrous ammonium sulfate has been studied by the dissolution of the irradiated salt in deaerated water with subsequent wet and gaseous analyses. The products of decomposition were found to be ferric ion, sulfite ion and hydrogen. (auth)

168

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 7. NUCLEAR CHEMISTRY AND EFFECTS OF IRRADIATION. New York, United Nations, 1956. 691p. $10.00.

RADIATION EFFECTS

169 AD-89451

Armed Services Technical Information Agency Reference Center, Library of Congress, Washington, D. C.
THE EFFECTS OF RADIATION ON MATERIALS: A REPORT BIBLIOGRAPHY. Feb. 1956. 17p. (ARC-3694).

This bibliography is a reproduction of catalog cards covering government-sponsored research on the effects of radiation on alkali halide crystals, crystals and semiconductors, glass and optical materials, metals and alloys, organic compounds, packaging materials, photographic film and emulsions, plastics and elastomers, and miscellaneous materials. (C.H.)

170 AD-93436

Armed Services Technical Information Agency Reference Center, Library of Congress, Washington, D. C.
THE EFFECTS OF RADIATION ON MATERIALS: A REPORT BIBLIOGRAPHY. Apr. 1956. 14p. (ARC-3694 (Suppl. 1)).

This bibliography is a reproduction of catalog cards covering government-sponsored research on the effects of radiation on crystals, glass and optical materials, inorganic compounds, metals and alloys, organic compounds, photographic film and emulsions, plastics and elastomers, and miscellaneous materials. (C.H.)

171

ACTION OF IONIZING RADIATION ON INSULATING PLASTICS. L. Ehrenberg and K. G. Zimmer (Univ. of Stockholm, Sweden and Max-Planck-Institut fur physikalische Chemie, Gottingen, Germany). Acta Chem. Scand. 10, No. 5, 874-5(1956).

Experiments with Co^{60} gamma-radiation effects on such materials as "Plexiglas", "Teflon", and "Kel F" are described. (T.R.H.)

172

CHEMICAL ACTIVITY OF GAMMA-IRRADIATED POLYMETHYL METHACRYLATE. Leo A. Wall and Daniel W. Brown. J. Research Natl. Bur. Standards 57, 131-6 (1956) Sept.

In studies of polymerization and depolymerization with γ-irradiated polymethyl methacrylate, effects were observed indicative of long-lived free radicals in the solid polymer. With a dose of 10^7 roentgens, the free-radical concentration, as measured by both types of experiments, is estimated to be at least 10^{-5} mole per liter. When irradiated in air the polymer contains peroxide structures of at least 10^{-3} mole per liter concentration. The decomposition of these peroxidic groups is accelerated by tert-butyl catechol and is associated with the production of scissions in the polymer chain. (auth)

173

DECOMPOSITION OF PLUTONIUM OXALATES BY INTRINSIC ALPHA RADIATION. V. V. Fomin, R. E. Kartushova, and T. I. Rudenko. Soviet J. Atomic Energy, No. 3, 409-13(1956).

Decomposition of the oxalates of tri-, tetra- and hexavalent plutonium was studied in air and in a vacuum at room temperature and −80° both under illumination and in darkness. It was found that the decomposition is caused by alpha radiation from the plutonium, but in the oxalates of tetra- and hexavalent plutonium the carbon monoxide which is formed acts as a reducing agent which transforms the tetravalent plutonium to the trivalent form and the hexavalent to the tetravalent. The oxalates are then transformed into carbonates and, apparently, also partially into oxides or an oxyoxalate−carbonate mixture. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

174

STRUCTURAL CHEMISTRY OF THE ALKOXIDES. PART VII. SECONDARY ALKOXIDES OF QUADRIVALENT CERIUM AND THORIUM. D. C. Bradley, A. K. Chatterjee, and W. Wardlaw (Birkbeck Coll., London). J. Chem. Soc., 3469-72(1956) Sept.

Ceric secondary alkoxides, $Ce(O{\cdot}CHR_2)_4$ where R = Me or Et, and $Ce(O{\cdot}CHMeR)_4$ where R = Et, Pr^n, or Pr^i, have been prepared and their molecular weights determined ebullioscopically in benzene and in toluene. Ceric tetraisopropoxide sublimed at 160° to 170°/0.05 mm. but the other derivatives were non-volatile. The non-volatile Th secondary alkoxides $Th(O{\cdot}CHEtR)_4$, where R = Me or Et, have also been prepared and their molecular weights determined ebullioscopically in benzene. The molecular weights and volatilities of the secondary alkoxides of Te, Zr, Ce(IV), and Th are discussed from the theoretical viewpoint. (auth)

175

THE REACTION BETWEEN CERIUM(III) AND COBALT (III). PART I. THE PERCHLORATES. L. H. Sutcliffe and J. R. Weber (Univ. of Liverpool, England). Trans. Faraday Soc. 52, 1225-34(1956) Sept.

A kinetic study of the reaction between Co^{3+} and Ce^{3+} ions in $HClO_4$ has led to the postulation that a perchlorate complex of Ce^{3+} takes part in the rate-determining step, which is $CeClO_4^{2+} + CoOH^2 \rightarrow Ce^{4+} + Co^{2+}$. Values of the true rate constant have been found independently from studies at constant perchlorate ion concentration and at constant $HClO_4$ concentration. The true activation energy was found to be 19 ± 2 kcal/mole and the entropy of activation 14 ± 7 cal/mole deg. Spectrophotometric measurements

have enabled the association constants and corresponding heats of reaction of the two complexes to be determined. (auth)

SEPARATION PROCEDURES

176 AECU-3181

Bureau of Mines. Intermountain Experiment Station, Salt Lake City.

SOLVENT EXTRACTION SEPARATION OF URANIUM FROM ACID LEACH LIQUORS AND PULPS. J. R. Ross, J. B. Rosenbaum, and J. B. Clemmer. Apr. 1956. 21p. (RR-43.1).

The development of a solvent extraction process for recovering U from H_2SO_4 leach liquors and pulps is summarized. Mention is made of the laboratory studies by research contractors for the Division of Raw Materials, Atomic Energy Commission, to find suitable organic extractants. The pilot plant work at Salt Lake City in cooperation with Dow Chemical Co., using a kerosene solution of mono ortho dodecyl phosphoric acid, is reviewed and discussed. Possibilities in the use of other extractants such as di-2 ethyl hexyl phosphoric acid and long-chain amines are noted. A tentative design is projected for a solvent extraction plant using DDPA for recovering 1,000 lb of U_3O_8 daily from H_2SO_4 leach liquor or slime slurry. (auth)

177 AECU-3356

Ionics, Inc., Cambridge, Mass.

PROGRESS REPORT [FOR] FEBRUARY 15 TO MARCH 12, 1954. Edward A. Mason. Mar. 15, 1954. 7p. For Westinghouse Electric Corp. Atomic Power Div. Subcontract 14-316. $1.80(ph OTS); $1.80(mf OTS).

Work was started on continuous mixed-bed regeneration and a cost analysis of the purification of lithium by removing Na from resins. (F.S.)

178 AECU-3357

Ionics, Inc., Cambridge, Mass.

PROGRESS REPORT [FOR] MARCH 15 TO APRIL 15, 1954. Carolus M. Cobb. Apr. 23, 1954. 9p. [For Westinghouse Electric Corp. Atomic Power Div.]. $1.80 (ph OTS); $1.80(mf OTS).

The analysis of the WAPD loop sample was completed and work is in progress on the radioactive resin beds from Arco. Methods were developed for analyzing resins for N. Work on the exchange between borate ions and an anion exchange resin was initiated to study suitable conditions for the preparation and treatment of borate form anion resins and to predict the behavior of the borate resin with various borate concentrations. (F.S.)

179 AECU-3360(Pt. I)

Michigan. Univ., Ann Arbor.

RADIOCHEMICAL SEPARATIONS. I. BARIUM STRONTIUM, AND CALCIUM. Duane N. Sunderman and W. Wayne Meinke. [1955?]. 42p. Contract [AT(11-1)-70]. (M-5783(Pt. I)). $7.80(ph OTS); $3.30(mf OTS).

Radiochemical separation procedures for Ba, Sr, and Ca are reviewed and individual separation steps which are generally applicable are studied to determine optimum conditions. The results are tabulated. (T.R.H.)

180 AECU-3360(Pt. II)

Michigan. Univ., Ann Arbor.

RADIOCHEMICAL SEPARATIONS. II. SEPARATION OF RADIOACTIVE SILVER BY ISOTOPIC EXCHANGE. Duane N. Sunderman and W. Wayne Meinke. [1955]. 21p. Contract [AT(11-1)-70]. (M-5783(Pt. II)). $4.80(ph OTS); $2.70(mf OTS).

An isotopic exchange process has been adapted to the separation of radioactive Ag from a mixture of radioactive species. The method is rapid, specific, and quantitative. (T.R.H.)

181 BM-RI-5239

Bureau of Mines.

SEPARATION OF TANTALUM–COLUMBIUM BY SOLVENT EXTRACTION. K. B. Higbie and J. R. Werning. Dec. 1955. 53p.

The quantitative separation of Ta from Nb has been obtained through several liquid-liquid extraction processes. Both Ta and Nb products of greater than 99% purity were obtained when HF–HCl solution of mixed hydrated oxides was contacted with methyl isobutyl ketone. (W.L.H.)

182 CF-53-6-176

Oak Ridge National Lab., Tenn.

A PROCESS FOR URANIUM AS A SINGLE PRODUCT FROM LZ ORE USING MINIMUM SULFURIC ACID: A PRELIMINARY COST ESTIMATE. C. F. Coleman, F. A. Schimmel, and K. B. Brown. June 30, 1953. Decl. June 27, 1956. 28p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

A preliminary cost estimate is presented to aid in appraising the place and value in the leached zone program of a process for recovery of U as a single product by low H_2SO_4 leaching. The resulting estimated cost per pound of U is for the production costs only; it does not include any allowance for the price of the uranium in the ground or for operating profit. (auth)

183 DOW-146

Dow Chemical Co. Western Div., Pittsburg, Calif.

ENTRAINMENT OF SOLVENT IN EXTRACTION OF URANIUM FROM HEAVY SLURRIES. J. B. Byrne. July 30, 1956. 35p. Contract AT(30-1)-GEN-236. $6.30(ph OTS); $3.00(mf OTS).

A study of the factors that cause entrainment of solvent in the recovery of U from heavy slurries by the solvent extraction process is reported. Reduction of the entrainment by dilution with water or by the addition of surface active agents was investigated. (auth)

184 HW-43463

[Hanford Atomic Products Operation, Richland, Wash.].

NUCLEAR SAFETY OF RIGHT ELLIPTIC AND RIGHT ANNULAR CYLINDERS. Norman Ketzlach. June 1, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

Comparisons are made of elliptical and annular cross-sectional areas (capacity parameters) of safe vessels so that vessel shape may be evaluated as one of the parameters in any design for separations plants. (F.S.)

185 NYO-7782

Aeroprojects, Inc., West Chester, Penna.

INVESTIGATIONS TO DETERMINE THE FEASIBILITY OF ULTRASONIC LIQUID-LIQUID EXTRACTION. Progress Report No. 7 Covering Period August 1 to September 30, 1956. Oct. 1956. 16p. Contract AT(30-1)-1798. $3.30(ph OTS); $2.40(mf OTS).

Analytical techniques for determination of U content in solutions containing $UO_2(NO_3)_2$ were established, and preliminary experiments in the transfer of $UO_2(NO_3)_2$ established the superiority of ultrasonic over non-ultrasonic extraction in the experimental array. Problems in the design and operation of ultrasonic emulsion-breaking equipment were partially overcome and successful accomplishment of continuous emulsion breaking appears imminent. Assembly of an ultrasonic multistage mixer-settler device was initiated and some of the experimental problems in small scale effective liquid transport from one stage to another were delineated. (For preceding period see NYO-7781.) (auth)

186 ORNL-1970(Del.)

Oak Ridge National Lab., Tenn.

RAW MATERIALS PROCESS TESTING. Progress Report of Pilot Plant Section [for] January 1955. K. O. Johnsson, ed. Nov. 7, 1956. 21p. Contract W-7405-eng-26. $0.25 (OTS).

Progress is reported on the recovery of U and V from H_2SO_4 leach liquors by amine extraction and on the development of mixer-settlers for solvent extraction of U leach slurries. (W.L.H.)

187 TID-10142

Hanford Atomic Products Operation, Richland, Wash.

DECONTAMINATION OF BISMUTH PHOSPHATE PROCESS FIRST CYCLE WASTE SUPERNATANTS. R. E. Burns, H. S. Gile, and C. R. McMullen. Sept. 10, 1953. Decl. Oct. 2, 1956. 17p. Contract [W-31-109-Eng-52]. $0.30 (OTS).

First decontamination cycle wastes from the Hanford Atomic Products Operations Bismuth Phosphate Process are made alkaline and stored in large underground tanks. Settling of solids produced on making the wastes alkaline effects considerable decontamination but not enough that very large volumes of the supernatants can be discharged to ground. The effectiveness of tannic acid, Ca_2PO_4, CaC_2O_4, $Fe_4[FeCN_6]_3$, and Fe_2FeCN_6 as carrier precipitates, and CaC_2O_4, Attaclay, and Attapulgus clay as solid adsorbents for the decontamination of supernatants from aged first cycle wastes has been studied. Plutonium, fission-product, and gross salt content of supernatants from several waste tanks are given along with decontamination factors for Pu and fission products obtained when these supernatants were treated under varying conditions with the adsorbents and carrier precipitates noted above. (auth)

188

CHEMICAL PROCESSING OF AQUEOUS BLANKET AND FUEL FROM THERMAL BREEDER REACTORS. F. R. Bruce (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 52, 347-52(1956) Sept.

The principles of thermal breeder reactor fuel and blanket processing are discussed, and flowsheets for a three-reactor power station described. (T.R.H.)

189

COUNTERCURRENT ION EXCHANGE. T. A. Arehart, J. C. Bresee, C. W. Hancher, and S. H. Jury (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 52, 353-9(1956) Sept.

The principles of the countercurrent ion-exchange column method of separation are discussed. Its development and application to the processing of low-grade Western uranium ores is described. (T.R.H.)

190

URANIUM REFINERY WASTE CLARIFICATION. G. M. Reinhart and D. W. Glass (National Lead Co. of Ohio, Fernald). Chem. Eng. Progr. 52, 360-1(1956) Sept.

The results of experiments with a lab Dorr thickener for precipitation and separation of solids from uranium refinery process waste are reported. Magnesia was more effective than lime in neutralization and precipitation and an overflow containing less than 10% of the U feed was obtained. (T.R.H.)

191

NITRIC ACID RECOVERY FROM RAFFINATE BY EVAPORATION AND FRACTIONAL DISTILLATION. D. S. Arnold, A. Whitman, and F. J. Podlipec (National Lead Co. of Ohio, Fernald). Chem. Eng. Progr. 52, 362-5(1956) Sept.

A twelve-plate fractionating column has been found to exhibit efficiencies of 33 to 54% with HNO_3 vapor feed from a raffinate evaporator. (T.R.H.)

192

THE CONCATENATED PULSE COLUMN. A. C. Jealous and E. Lieberman (Oak Ridge National Lab., Tenn.). Chem. Eng. Progr. 52, 366-70(1956) Sept.

The concatenated pulse column is described in detail and its operation and engineering properties discussed. (T.R.H.)

193

EVALUATION OF PROCESS VARIABLES IN THE RECOVERY OF SPENT REACTOR FUEL. Frank P. Vance and Fred H. Tingey (Phillips Petroleum Co., Idaho Falls, Idaho). Chem. Eng. Progr. 52, 375-80(1956) Sept.

The application of the mathematical theory of the "analysis of variance" to general problems in plant material balance calculation is discussed here. Also given is the derivation of a graphic plot which includes an empirical operating line indicating the safe number of batches which can be charged to a spent enriched uranium reactor fuel dissolver. (auth)

194

DIRECT MAINTENANCE FUEL PROCESSING PLANT IS PRACTICAL. D. G. Reid and K. K. Kennedy (Phillips Petroleum Co., Idaho Falls, Idaho). Chem. Eng. Progr. 52, 394-5(1956) Sept.

The practicality of direct maintenance as opposed to remote maintenance of reactor fuel processing plants is discussed. (T.R.H.)

195

ETHYLENE DIAMINE TETRAACETIC ACID AND CITRIC ACID AS ELUANTS IN ION EXCHANGE SEPARATION OF RARE EARTHS. F. W. Cornish, G. Phillips, and A. Thomas (Atomic Energy Research Establishment, Harwell, Berks, England). Can. J. Chem. 34, 1471-82(1956) Oct.

Studies of the distribution of rare earths between the cation exchange resin Zeokarb 225 and solutions of ethylene diamine tetraacetic acid (EDTA) show the existence of large separation factors between members of this series. However, column experiments show that the separation is poorer than with citric acid, probably because of a slow process occurring in the solution. The variation of column efficiency with distribution coefficient has been examined. Elution of europium with citric acid appears to be diffusion controlled, while that with EDTA is not. Further experiments with strontium indicate that its elution with both EDTA and citric acid is diffusion controlled. The results are in general agreement with Glueckauf's equation relating column variables with the height equivalent to a theoretical plate. Column irregularities appear to account for the very low diffusion constants calculated from this relation. (auth)

196

SEPARATION OF HIGH SPECIFIC ACTIVITY Na^{22} FROM IRRADIATED ALUMINUM. N. Hollbach and L. Yaffe (McGill Univ., Montreal, Quebec, Canada). Can. J. Chem. 34, 1508-9(1956) Oct.

A method has been developed for the separation of high specific activity Na^{22} from irradiated Al by a cation exchange resin. The process recovered 99.8% of the original Na^{22} activity and was radiochemically pure. (W.L.H.)

197

RECENT EXPERIMENTS ON THE PRODUCTION OF HEAVY WATER BY ELECTROLYSIS AND ION EXCHANGE REACTIONS. S. Finzi, R. Renzoni, and M. Silvestri (Laboratori CISE, Milan). Energia nucleare (Milan) 3, 294-308 (1956) Aug. (In Italian)

A series of experiments in connection with the production of heavy water by electrolysis and isotopic exchange reactions is described here. Laboratory experiments were carried out at CISE while those on industrial scale were made at the Nera Montoro electrolytic plant with the cooperation of the Societa Terni. (auth)

198

EFFECT OF FUEL DILUENT ON REPROCESSING COSTS. Archie M. Larson, Jr. (Internuclear Co., Clayton, Mo.). Nucleonics 14, No. 10, 80 & 82(1956) Oct.

There are only two major factors affecting the reprocessing costs for fully enriched fuel elements. The most important of these is the degree by which the enriched U fuel is diluted with alloying and cladding material. The other factor is the type of diluent material used. (W.L.H.)

199

METHODS OF ISOLATION OF CARRIER-FREE RADIOACTIVE ISOTOPES. PRODUCTION OF RADIOCHEMICALLY PURE ThB AND ThC. N. P. Rudenko (Second Research Inst. of Physics, Moscow State Univ.). Zhur. Anal. Khim. 11, 371-5(1956) July–Aug. (In Russian)

A rapid and simple extraction method for separation of radioisotopes ThB(Pb^{212}) and ThC(Bi^{212}) has been developed. Radiochemically pure preparations of Pb and Bi radioisotopes, both carrier free and with carrier, were obtained by the newly developed method. (tr-auth)

200

SEPARATION OF BERYLLIUM FROM ALUMINUM AND OTHER ELEMENTS BY EXTRACTION METHOD. I. P. Alimarin and I. M. Gibalo (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 11, 389-92(1956) July-Aug. (In Russian)

The extraction of acetylacetonates of Al, Cr, Co, Fe, Ni, Mn, Zn, Cd, Pb, Cu, Ca, and Mg in the presence of the trilon B by organic solvents (carbon tetrachloride, chloroform, n-butanol, and isoallyl alcohol) has been studied. Experiments were made of quantitative extraction of acetylacetonate of Be in the presence of the trilon B and its separation from Al. A rapid and accurate method of separation and determination of Be in bronze has been developed. (tr-auth)

201

ON THE COMPOSITION OF URANYL SELENITE VOLUMETRIC DETERMINATION OF URANIUM. M. K. Djoshi. Zhur. Anal. Khim. 11, 495-7(1956) July-Aug. (In Russian)

Uranyl selenite is precipitated quantitatively by adding an aqueous solution of selenious acid to a uranyl salt solution in 50% alcohol in a pH range 4 to 5. The precipitate is dissolved in concentrated HCl, and a method for the volumetric determination of U is described, based on the iodometric titration of the liberated selenious acid. The experimental results show that the composition of the selenite is $UO_2(SeO)_3$. (tr-auth)

202

AN ELECTROMAGNETIC ISOTOPE SEPARATOR. René Bernas (College de France, Paris and Charles Cassignol (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1094-1100(1955) Nov. (In French)

The principles of electromagnetic separation of isotopes are reviewed, and detailed descriptions are given of the C.E.A. electromagnetic separator. (B.J.H.)

203

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 8. PRODUCTION TECHNOLOGY OF THE MATERIALS USED FOR NUCLEAR ENERGY. New York, United Nations, 1956. 627p. $10.00.

Refer to abstract 659.

SORPTION PHENOMENA

204

A LABELED ATOM STUDY OF THE INVERSION OF ADSORPTION SERIES IN ULTRA-MICROCONCENTRATION RANGE. S. Yu. Elovich and L. G. Kuz'mina (Moscow Inst. of Physical Chemistry). Kolloid. Zhur. 18, 268-75(1956) May-June. (In Russian)

A chromatographic separation of ions on organic ion exchangers may be followed by inversion of adsorption series. Adsorption statistics and dynamics were studied with Cs^{137}, Sr^{89}, and Ce^{141} radioisotopes and HCl solutions of various concentrations. The theory of the process has been developed and generalizations were shown to be in agreement with experimental facts. (tr-auth)

SPECTROSCOPY

205 AERE-Lib/Trans-513

ON THE ANALYSIS OF SOME COMPLEX SPECTRA (Th AND U). (Over De Analyse Van Enige Complexe Spectra (Th on U)). P. Schuurmans. Translated by G. W. Cox from Physica 12, 589-94(1946). 75p.

The analysis of complex spectra is discussed and examples are given. The (jj) coupling of the S electron is discussed, and the hyperfine structure of a number of Pr II levels is considered in view of this coupling. A survey is given of the largest Th II system. A number of levels of the configurations $5f7s^2$, 5f6d7s, $5f6d^2$, 5f7p7s, 5f6d7p, $5f^27s$, and $5f^26d$ are identified. One of the systems, found in the analysis of the spectrum of U, is discussed. A derivation of the formulas of the configuration p^3 is given. Formulas regarding configurations with f electrons are given. (J.H.M.)

206

SPECTROPHOTOMETRIC INVESTIGATION OF SOME ANALYTICAL IMPORTANT COMPLEXES OF Ti IN SOLUTION. Arnošt Okáč and Lumír Sommer (Institut für analytische Chemie der Universitat, Brno (Tschechoslovakei)). Anal. Chim. Acta 15, 345-55(1956) Oct. (In German)

The stepwise formation of complexes was demonstrated spectrophotometrically in solutions containing colored complexes of titanium with chromotropic acid, pyrocatechol, tiron, sulfosalicylic acid, gallic acid and pyrogallolcarboxylic acid in acid medium. In dilute acid solutions of complexes a simple complex TiR is usually formed, in weakly acid buffer solutions a relatively stable complex TiR_3 is formed, which, however, up till now has not been demonstrated in the case of sulfosalicylic and pyrogallolocarboxylic acid. The stability of the chelates formed is directly related to their absorption spectra and the hydrogen bond stability between the functional groups of the ligand. Formation of a simple stable complex is a necessary condition for the development of an exact photometric method. From this point of view some methods for determination of titanium have been discussed. (auth)

SYNTHESES

207 NP-6113

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

COORDINATION POLYMERS. Bimonthly Progress Report No. 10 [for] July 1, 1956 to August 31, 1956. Dept. of Chemistry. W. C. Fernelius, N. R. Garofano, D. E. Goldberg, D. F. Martin, and F. D. Thomas, II. 32p. Contract AF33(616)-2742.

4-(4-N,N-dimethylaminophenyl)-3,5-diacetyl-2,6-heptanedione, $(CH_3CO)_2CHCH[pC_6H_4N(CH_3)_2]CH(COCH_3)_2$, has been obtained in a pure state. Terephthalylbis(p-methoxyacetophenone), 1,4-$(CH_3CO$-⬭-$COCH_2CO)_2C_6H_4$, and isophthalyldiacetophenone, 1,3-$(C_6H_5COCH_2CO)_2C_6H_4$, have been prepared by the Claisen condensation. A volumetric method for alkoxide determination has been suc-

cessfully applied to the compound $[(CH_3)_2CHO]_2Ti(C_5H_7O_2)_2$. This compound forms additive products with tetraacetylethane, a bis(β-diketone). Tetra-n-butoxy titanium, $(n\text{-}C_4H_9O)_4Ti$, also forms an additive product with this bis(β-diketone). However, absolute methanol attacks these additives. Thermal stability of salts of 0,0′-diethyldithiophosphate is low. Other work on phosphorus compounds has been relatively unproductive. 4,4′-Bis(4-tert.butylphenol-2-diazo)-3,3′-dimethoxybiphenyl and 4,4′-bis(4-methylphenol-2-diazo)-3,3′-dimethylbiphenyl have been prepared. The copper derivative of 4,4′-bis(4-methylphenol-2-diazo)-3,3′-dimethoxybiphenyl has been prepared and purified. (auth)

208 NP-6114

Midwest Research Inst., Kansas City, Mo.

DEVELOPMENT OF THERMALLY STABLE SILICON CONTAINING RESINS. Quarterly Progress Report No. 2 [for] July–September 1956. Chemistry Div. L. W. Breed. 16p. M.R.I. Project No. 786-C-108. Contract AF33(616)-3675.

Work was continued on the preparation of polyarylenesiloxanes which are thermosetting and which may be used for resins and adhesives that are stable above 500°F and resistant to chemical attack. Attempted syntheses of 4,4′-bis(methyldiethoxysilyl) biphenyl and 4,4′-bis(methyldiethoxysilyl) phenyl ether were described. (C.W.H.)

209 NP-6131

Illinois. Univ., Urbana.

QUARTERLY PROGRESS REPORT FROM JULY 1956 TO OCTOBER 1956. Carl S. Marvel. Sept. 1956. 29p. Project Title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task Title: SYNTHESIS OF POLYNUCLEAR AND INORGANIC POLYMERS FOR HIGH-TEMPERATURE AIRCRAFT APPLICATION. Contract AF33(616)-3772.

Details of attempts to prepare 1,3-cyclohexadiene free from peroxides are given. Diethyl α,α′-dimethylenepimelate and diethyl, α,α′-dimethyleneadipate have been synthesized and polymerized. Some experiments on tetracyano aromatics as monomers for polymeric phthalocyanines are described. (T.R.H.)

TRACER APPLICATIONS

210

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 15. APPLICATIONS OF RADIOACTIVE ISOTOPES AND FISSION PRODUCTS IN RESEARCH AND INDUSTRY. New York, United Nations, 1956. 327p. $7.50.

TRANSURANIC ELEMENTS AND COMPOUNDS

211

THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART V. COLLOIDAL QUADRIVALENT PLUTONIUM. D. W. Ockenden and G. A. Welch (U. K. Atomic Energy Authority, Windscale Works, Cumb., England). J. Chem. Soc., 3358-63(1956) Sept.

Colloidal, or polymeric, quadrivalent Pu has been separated from the ionic species of Pu by ion exchange. The absorption spectrum of the colloid is distinctive, quite different from those of other species of Pu and varies slightly with the method of preparation. The rate of formation of the polymer in dilute HNO_3, its stability in more concentrated acid, its adsorption on certain surfaces, and other properties have been studied. The minimum and maximum molecular weights of the colloid have been calculated from diffusion experiments and from work with nuclear emulsion plates. (auth)

Refer to abstract 769.

URANIUM AND URANIUM COMPOUNDS

212 IDO-14381

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

DISTRIBUTION OF URANIUM AT LOW ACID–LOW URANIUM CONCENTRATIONS INTO 4½ PERCENT TBP–AMSCO. R. L. Andelin, E. L. Anderson, and W. H. McVey. Aug. 23, 1956. 26p. Contract AT(10-1)-205. $0.35(OTS).

Acid free $UO_2(NO_3)_2 \cdot 4H_2O$ was prepared and its distribution into 4½% TBP–Amsco 125-90W in the aqueous concentration range 1 gram per liter to 30 grams per liter was measured. Acid concentrations were varied from 0.00M added acid to 0.06M added acid. Uranium distribution was found to be strongly dependent on HNO_3 and U concentrations as expected. Hydrolysis effects under these conditions were studied. No attempt was made to measure HNO_3 distribution. A value of 171.8 was found for the thermodynamic equilibrium constant in the reaction for complexing of $UO_2(NO_3)_2$ by TBP. (auth)

213 MLM-1021

Mound Lab., Miamisburg, Ohio.

THE DENSITY, VISCOSITY, AND SURFACE TENSION OF LIGHT AND HEAVY WATER SOLUTIONS OF URANYL SULFATE AT TEMPERATURES TO 250°C. Final Report. M. K. Barnett, J. R. Heiks, L. V. Jones, and E. Orban. Dec. 6, 1954. Decl. Feb. 13, 1956. 30p. Contract AT-33-1-GEN-53. $0.25(OTS).

The results of measurements of density, viscosity, and surface tension of light and heavy water solutions of UO_2SO_4 at elevated temperatures are tabulated. For the light water solutions, density measurements were made over a concentration range of 0 to 100 g of U/l of solution; viscosity measurements were made over a concentration range of 0 to 400 g of U/l of solution; and surface tension measurements were made over a range of 0 to 60 g of U/l of solution. For the heavy water solutions, all measurements were made over a concentration range of 0 to 60 g of U/l of solution. Density and viscosity measurements began at 30°C and surface tension measurements began at 100°C; all measurements extended to approximately 250°C. Values of the properties at 325°C were estimated by extrapolation of the data from lower temperatures. The effect of oxygen overpressure on the density of light water solutions containing 60 g of U/l of solution is shown. (auth)

214 ORNL-1959

Oak Ridge National Lab., Tenn.

AMINE EXTRACT PROCESSES FOR URANIUM RECOVERY FROM SULFATE LIQUORS. VOL. I. D. J. Crouse and K. B. Brown. Sept. 30, 1955. 84p. Contract W-7405-eng-26.

Bench scale studies have been made of processes for recovery of U from ore leach liquors by solvent extracting with long chain amines in an organic diluent. Several process schemes have been evaluated which show considerable promise both from the standpoint of operation and chemical costs. (auth)

215 TID-7518(Pt. 1)

Oak Ridge Operations Office, AEC.

INDUSTRIAL TECHNICAL INFORMATION MEETING ON COLD PROCESSING OF ENRICHED URANIUM, OAK RIDGE, SEPTEMBER 13-15, 1956. 99p. $0.50(OTS).

Material accountability, quality control, and analytical

procedures at Y-12 are discussed. The general problems associated with health physics aspects of U processing are reviewed. The hydrolysis of UF_6 and the preparation of pure compounds from the UO_2F_2 solution are described. (C.W.H.)

216

ON THE COMPLEX CHEMISTRY OF THE URANYL ION. VIII. THE COMPLEXITY OF URANYL FLUORIDE. Sten Ahrland, Ragnar Larsson, and Kjell Rosengren (Univ. of Lund, Sweden). Acta Chem. Scand. 10, No. 5, 705-18(1956).

The complexity of the UO_2F_2 system has been determined by measurements of $[H^+]$ in fluoride buffers. A perchlorate medium of ionic strength 1M was used at a temperature 20°C. In the concentration range investigated ($C_M \leq .100M$; $C_A \leq .400M$) a strong mononuclear complex formation takes place between UO_2^{2+} and F^-, with $UO_2F_4^{2-}$ as the upper limit. Neither polynuclear complexes, nor complexes containing HF_2^- seem to exist in this range. The constants of the HF system in the present medium were also obtained. (auth)

217

KINETICS OF THE OXIDATION OF URANIUM(IV) BY MOLECULAR OXYGEN IN AQUEOUS PERCHLORIC ACID SOLUTION. J. Halpern and J. G. Smith (Univ. of British Columbia, Vancouver). Can. J. Chem. 34, 1419-27(1956) Oct.

The kinetics of the oxidation of U^{4+} by molecular O_2 in aqueous perchloric acid solution were studied. Over a considerable range of conditions, the results are fitted approximately by the rate law: $-d[U^{IV}]/dt = k[U^{IV}]\,[O_2]/[H^+]$, where $k \approx 2 \times 10^{14} \exp[-22{,}000/RT]\,sec.^{-1}$. The reaction is catalyzed by Cu^{++} and inhibited by small amounts of Ag^+ and Cl^-. The results are interpreted in terms of a chain reaction mechanism involving UO_2^+ and HO_2 as chain carriers. (auth)

218

PROPERTIES AND PREPARATION OF UF_6. L. Malatesta and R. Sesini (Universita di Milan and Laboratori CISE, Milan). Energia nucleare (Milan) 3, 287-93(1956) Aug. (In Italian)

Experimental equipment used for obtaining UF_6 starting with F_2 production which is led to react with UF_4 is described. The UF_6 is then cleared of impurities of HF acid through distillation under vacuum at low temperatures. (F.S.)

219

DENSITY OF AQUEOUS SOLUTIONS AND APPARENT MOLAL VOLUMES OF URANYL NITRATES. A. F. Kapustinskiĭ and I. I. Lipilina (Kurnakov Inst. of General and Inorganic Chemistry). Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk. 649-57(1956) June. (In Russian)

Pycnometers with capillary necks were used for determination of the density of aqueous solutions with an accuracy of 0.001%. Investigations were made of uranyl nitrate solution density in concentrations from 0.7 to 52.4 wt.% with the accuracy order of 0.01. The apparent molal volume of uranyl nitrates in aqueous solution at 25° was expressed as $\varphi V_{UO_2(NO_3)_2} = 65.9 + 5.23\sqrt{m}$. The apparent molal volume for uranyl ion UO_2^{2+} in infinitely diluted aqueous solution at 25° was calculated as 7.1 ml/g-ion. (R.V.J.)

220

HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF URANIUM(IV) OXYCHLORIDE AND URANIUM(IV) OXYBROMIDE FROM 10 TO 350°K. Elliott Greenberg and Edgar F. Westrum, Jr. (Univ. of Michigan, Ann Arbon). J. Am. Chem. Soc. 78, 5144-7(1956) Oct. 20.

Low temperature heat capacity measurements have been made on uranium(IV) oxychloride and uranium(IV) oxybromide, and the data have been used to calculate the entropy, enthalpy and free energy functions for these substances. At 298.16°K, the molal values of C_p, S^0 and $H^0 - H_0^0$ are 22.72 ± 0.03 cal./deg., 33.06 ± 0.05 cal./deg., and 4586 ± 7 cal., respectively, for $UOCl_2$, and 23.42 ± 0.03 cal./deg., 37.66 ± 0.06 cal./deg., and 4989 ± 7 cal. for $UOBr_2$. (auth)

221

SOME ASPECTS OF THE SYSTEM URANIUM TRIOXIDE–WATER. J. K. Dawson, E. Wait, K. Alcock, and D. R. Chilton (U. K. Atomic Authority, Harwell, Berks, England). J. Chem. Soc., 3531-40(1956) Sept.

Uranium trioxide in contact with H_2O at about 180° gives an orthorhombic hydrate, $UO_3 \cdot {}^4/_5H_2O$, with the cell dimensions a = 10.23 ± 0.01, b = 6.89 ± 0.01, c = 4.28 ± 0.01 A. These dimensions appear to vary slightly with deviation of the H_2O content from 0.8 mole per U atom. Between 200° and 280° another phase appears, $UO_3 \cdot H_2O$, also orthorhombic with cell dimensions a = 5.638 ± 0.005, b = 6.273 ± 0.005, c = 9.925 ± 0.005 A, space-group Pbca. The hemihydrate, $UO_3 \cdot {}^1/_2H_2O$ is stable in water above 280°. A further phase, possibly due to a relatively high pH and probably triclinic, was observed when the UO_3 was heated in H_2O at 230° in contact with glass. Some of the properties of these hydrates are described, together with observations on the preparation of pure anhydrous UO_3 from $UO_2(NO_3)_2$. (auth)

222

POSSIBLE f-ORBITAL HYBRIDIZATION IN URANYL AND RELATED COMPLEXES. C. A. Coulson and G. R. Lester (King's Coll., London). J. Chem. Soc., 3650-9(1956) Sept.

A theoretical study is made of the possible modes of description of the bonds in certain uranyl and related complexes. If a partial sexicovalent character is desired for the uranyl-ligand bonds, then *f* electrons must be considered to take part in the bonding. A discussion of the sizes and energies of these *f* orbits shows that the 6*f* is much more effective than the 5*f* for this purpose. It is concluded that this sexicovalency is one element in the total description, with ionic contributions probably predominant. There are other alternative descriptions of the covalency, which do not involve use of *f* orbitals in the formation of hybrids; but although these probably play some part, it seems likely that they need to be supplemented with hybrids. (auth)

223

QUANTITATIVE DETERMINATION OF U BY A SERIES OF INVESTIGATIONS. Günter Zeschke. Neues Jahrb. Mineral. Monatsh., No. 8, 179-87(1956) Aug. (In German).

224

THE PRICES OF URANIUM. Nucleonics 14, No. 10, 82 (1956) Oct.

Refer to abstract 813.

WASTE DISPOSAL

225 AECU-3339

Internuclear Co., Clayton, Mo.

DECONTAMINATION AND WASTE DISPOSAL IN INDIUM GAMMA IRRADIATION FACILITY. Lawrence C. Widdoes. May 14, 1956. 7p. A-1 Project. (IC-LCW-56-6). $1.80 (ph OTS); $1.80(mf OTS).

Draining and flushing should sufficiently decontaminate the irradiation equipment so that it can be maintained easily, but experimental work should be performed to make positive that indium, or some radioactive impurity, is not preferentially absorbed on equipment walls so that it cannot be removed by simple flushing. Even after 5 yrs decay it may be difficult to reduce, by dilution, the Tl and perhaps other impurities in commercial indium sulfate solution to drinking water tolerance, but the use of high purity indium in the loop could alleviate this situation. (auth)

ENGINEERING

226 KAPL-1592
Knolls Atomic Power Lab., Schenectady, N. Y.
OPTIMUM PARTICLE SIZE FOR PENETRATION THROUGH THE MILLIPORE FILTER. J. J. Fitzgerald and C. G. Detwiler. June 1, 1956. 23p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

The efficiency of the Millipore Filters, Types AA and HA, was established for collecting potassium permanganate aerosol in the size range of 0.005 to 2.1 μ. In previous studies of particle collection efficiency at KAPL, an optimum particle size for penetration through filters such as H-70, W-40, W-41, MSA-1106-B, and others, was observed. With the Millipore Filters, an optimum particle size for penetration was observed in the size range of 0.02 to 0.03 μ. Particle collection efficiency generally increased as face velocity decreased throughout the face velocity range tested, 40 to 10 cm/sec. Above 0.1 μ, collection efficiency for both filters exceeded 99%. For particle sizes between 0.1 and 0.01 μ, the particle collection efficiency varied in general over a wide range. For particles less than 0.01 μ, particle collection efficiency increased as particle size decreased, within the size range tested. (auth)

227 NP-6132
Mine Safety Appliances Co., Callery, Penna.
PROGRESS REPORT NO. 36 FOR AUGUST AND SEPTEMBER, 1956. W. J. Posey, ed. Oct. 10, 1956. 70p. Contract NObs-65426.

Tests are continuing on the 3000 KW steam generator. The unit has been subjected to a life test at cyclic conditions. The test system is shown schematically. The cycle test has been completed on the evaporator for the 3000 KW steam generator. A complete operational history of the evaporator is given. Stress tests are continuing on a tee in the S2G system used to join to liquid metal streams of different temperatures. The work on nitriding of Be, 347 stainless steel, and tool steel is complete; tables of corrosion rates of the three metals in liquid Na are presented. Methods of installing freeze seals and design of the seals are being investigated to prevent Na from being carried in the venting system of the S2G into the upper level reactor compartment. Radioactive leak experiments were continued. Isopropyl biphenyl, a proposed organic moderator coolant, is being tested in the Brookhaven pile. Tests are continuing on the effect of velocity on the corrosion rate in biphenyl at 800°F of 9 metals being considered in reactor design. Experiments have been performed on the corrosion of Zr at 800°F and 300 psig by water and/or dissolved oxygen in biphenyl. (For preceding period see NP-6068.) (W.L.H.)

228 WAPD-152
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHOCK DESIGN NOTES. C. M. Friedrich. July 1956. 77p. Contract AT-11-1-GEN-14. $12.30(ph OTS); $4.50 (mf OTS).

In connection with nuclear power plant design for submarines, special problems in shock analysis arise. To provide a basis for satisfactory shock design, the theory, mathematics, and calculation methods for these problems were reviewed and developed. Structures having one, two, and n degrees of freedom were considered. The equations developed for each case are given. (D.E.B.)

229 AERE-Lib/Trans-715
PRINCIPLES OF FLUIDIZATION. W. Brotz. Translated by R. C. Murray from Chem. Ing. Tech. 24, 60-81(1952). 52p.

The principles of fluidization of particulate solids and the properties of these "fluidized" systems are discussed. (T.R.H.)

HEAT TRANSFER AND FLUID FLOW

230 AD-95121
Stanford Univ., Calif.
HEAT TRANSFER AND FRICTION CHARACTERISTICS OF SCREEN MATRICES AT HIGH REYNOLDS NUMBERS. Technical Report No. 28. Long Sun Tong. Apr. 1956. 137p. Contract Nonr-225(23).

A review of previous data for screen matrices is presented, and the testing techniques used by previous experimenters are summarized. The principles involved in the transient technique with the large scale model matrix employed in the present work are presented. A detailed description of the construction of large scale model matrices, and a description of the testing technique and equipment used is presented. The effects on heat transfer and friction behavior of minor differences between the model and the prototype have been investigated experimentally, and the results of this investigation serve as a basis for converting the data obtained from the model to the performance of the prototype. Heat transfer and friction data for six matrices were measured by a transient technique in the Reynolds number range, 500 to 100,000. The data are presented both in tabular and graphical form. The curves of the present data are either smoothly connecting or overlapping with Coppage's data, which were obtained from actual screens, thereby verifying the validity of the large scale model technique. Empirical correlations for both the heat transfer and friction characteristics of the square-mesh screen matrices over the Reynolds number range of 1 to 100,000 are presented and compared with the previous data. The heat transfer rate and friction power loss in a pressurized water-cooled heterogeneous reactor built in the screen matrix form are analyzed. The present data have been applied to calculate the over-all performance of the reactor. Performance curves are presented in an appendix. (auth)

231 AECU-3274
Princeton Univ., N. J.
EFFECTS OF SURFACE TENSION AND VISCOSITY ON TAYLOR INSTABILITY. Ralph H. Pennington. Jan. 28, 1952. 44p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-1). $7.80(ph OTS); $3.30 (mf OTS).

The model used is that of two fluids of infinite depth, with the interface initially in the form of a sine wave with amplitude small compared to wave length. The fluids are considered incompressible, and only the linear terms of the equations of hydrodynamics are used. The first four chapters discuss the effects of surface tension and viscosity. The fifth gives a few numerical results to illustrate the main points of preceding chapters. (auth)

232 AECU-3279
Princeton Univ., N. J.
ASYMPTOTIC MOTION OF THE "SPIKE" IN TAYLOR INSTABILITY. David S. Carter. [1952?]. 7p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-6). $1.80(ph OTS); $1.80(mf OTS).

Asymptotic motion of the "spike" in Taylor instability was considered in the fluid-vacuum case with longitudinal and cylindrical symmetry. (F.S.)

233 AECU-3282
Princeton Univ., N. J.
PROPOSED NUMERICAL CALCULATION OF TAYLOR

INSTABILITY FOR COMPRESSIBLE FLUIDS. Ralph Pennington. Apr. 10, 1953. 33p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-9). $6.30(ph OTS); $3.00(mf OTS).

234 AECU-3284

[Princeton Univ., N. J.]

MACHINE CALCULATION OF THE GROWTH OF TAYLOR INSTABILITY IN AN INCOMPRESSIBLE FLUID. R. Pennington. [1953?]. 63p. [For Los Alamos Scientific Lab. Contract W-7405-eng-36]. (PNJ-LA-11). $10.80 (ph OTS); $3.90(mf OTS).

When two semi-infinite fluids having a common plane boundary are accelerated in a direction perpendicular to the interface between them, the interface is stable or instable according to the direction of the acceleration. The instable condition, Taylor Instability, occurs when the acceleration is directed from the less dense fluid to the more dense. In this case, a small perturbation on the interface, initially, say, a sine wave of small amplitude, will grow in amplitude. Eventually, the lighter medium forms troughs, or bubbles, moving into the heavy material, and the heavy material forms spikes into the lighter medium. The behavior of Taylor Instability in the small amplitude phase for incompressible fluids is well known. For extremely large amplitudes, the behavior near the top of the bubble of the lighter material is given in approximate form. The two extreme cases have been linked together to give an approximate theory for the behavior near the top of the bubble for all times. There is no complete theory of the behavior beyond the small amplitude phase, this machine calculation was devised to give description of the entire development in time. (auth)

235 AERE-CE/M-186

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY EXPERIMENTS ON THE RHEOLOGY OF THORIA SLURRIES. H. A. Kearsey. 1956. 7p.

Preliminary experiments using a Ferranti-Shirley and a pipe-line viscometer to determine the rheological properties of thoria slurries are described. The Ferranti-Shirley viscometer was unsuitable due to the settling of the thoria. A horizontal pipe-line viscometer can be used to investigate transition and turbulent flow conditions. To study the laminar flow region a vertical pipe-line viscometer is necessary to avoid errors due to settling of the thoria. (auth)

236 AERE-R/R-1981

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FREE CONVECTION IN HEAT GENERATING FLUID (LAMINAR FLOW). PART II. NEGATIVE TEMPERATURE GRADIENT. J. Woodrow. July 1956. 22p.

Two cases of laminar convective flow in a heat generating fluid are examined, in which the temperature in the container decreases with height. Velocity and transverse temperature distributions are obtained for two-dimensional and cylindrical containers, and the stability of the laminar regime discussed. (auth)

237 CF-55-9-165

Oak Ridge National Lab., Tenn.

A STATE-OF-THE-ART SURVEY ON ENGINEERING CALCULATIONS FOR SLURRY SYSTEMS. C. G. Lawson. Sept. 22, 1955. 15p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

238 CF-56-8-216

Oak Ridge National Lab., Tenn.

THE FLOW OF PLASTIC SLURRIES IN PIPES. C. G. Lawson. Aug. 28, 1956. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A friction factor plot is presented for use in predicting the pressure drop in circular ducts of slurries in laminar and non-laminar flow. (W.L.H.)

239 NP-6139

Princeton Univ., N. J.

HEAT TRANSFER IN OSCILLATING FLOW. Final Report on Work Performed July 1, 1953 to September 30, 1954. Aeronautical Engineering Report No. 266a. J. P. Layton. May 15, 1956. 129p. Contract AF33(038)-23976.

Research was conducted to determine the effect of low amplitude, audio-frequency oscillations in air flowing through a tube upon the over-all heat transfer from the tube wall to the flowing medium. The design, installation, and instrumentation of the flow system are included. An historical review and a selective bibliography applying to heat transfer in oscillating flow are given. The results indicated an increase in the rate of heat transfer of approximately forty per cent above that for steady flow under the conditions provided by the experimental apparatus. (J.H.M.)

240 WAPD-TH-217

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

PRELIMINARY DETERMINATION OF FORCED CONVECTION HEAT TRANSFER COEFFICIENTS FOR RECTANGULAR CHANNELS AT 2000 PSIA. J. D. Roarty and N. C. Sher. July 17, 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

During each of the pressure drop tests described in WAPD-TH-204, "Boiling Pressure Drop in Rectangular Channels", a series of thermocouple readings were recorded which represented temperature conditions near the outside wall of the rectangular test sections. These data, which can be interpreted in terms of heat transfer coefficients, were obtained under the test conditions reported in WAPD-TH-204. While it is planned to improve the technique herein described, the preliminary data reported may by qualitatively interpreted as minimum confirmation of the Dittus-Boelter and Jens and Lottes equations for predicting non-boiling and boiling heat transfer coefficients, respectively, in rectangular channels at 2000 psia. (auth)

241 AERE-Lib/Trans-775

USE OF RADIOACTIVE ISOTOPES FOR THE MEASUREMENT OF GAS FLOW VELOCITY AND FOR THE AUTOMATIC CONTROL OF GAS FLOW BY THE METHOD OF "TAGGED MOLECULES." N. N. Shymilovskii and L. V. Meltzer. Translated by J. E. Terry from Doklady Akad. Nauk S.S.S.R. 106, 661-4(1956). 6p.

The method of "tagged molecules" for the measurement of the velocity of gaseous flow was examined. It can only be applied when the time of passage of the package of ions to be determined is considerably smaller than the time necessary for the complete disappearance of the marker. (F.S.)

242 NACA-TM-1314

ON THE TURBULENT FRICTION LAYER FOR RISING PRESSURE. (Zur turbulenten Reibungsschicht bei Druckanstieg). K. Wieghardt and W. Tillmann. Translated by Mary L. Mahler from ZWB Untersuchungen und Mitteilungen Nr. 6617, Nov. 20, 1944. 46p.

Among the information presented are included displacement, momentum, and kinetic energy thicknesses, shearing stress distributions across the boundary layer, and surface friction coefficients. The Gruschwitz method and its modifications are examined and tested. An energy theorem for

the turbulent boundary layer is introduced and discussed but does not lead to a method for the prediction of the behavior of the turbulent boundary layer because relations for the shearing stress and the surface friction are lacking. (auth)

243

EQUATIONS FOR PLASTIC FLOW IN BOUNDARY LAYER. V. V. Sokolovskiĭ (Inst. of Mechanics). Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk. 20, 328-34(1956) May-June. (In Russian)

Equation integrals for plastic flow of a narrow layer along the curving line around a slip line were developed and may be applied in many similar problems. (R.V.J.)

244

INVERTED PROBLEM OF LAMINAR CAVITATION STREAMLINE OVER CURVILINEAR ARCS. H. N. Pykhteev. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk 20, 373-81(1956) May-June. (In Russian)

Mathematical analysis of a countercurrent stream is discussed. Calculations of a profile shape for specific distribution of velocities were developed by an inverted problem. In practice such inverted problems can be applied in designing rational blade shapes for turbines or pumps with high cavitation problem. (R.V.J.)

245

ON THE RESISTANCE RELATED TO THE LIFTING FORCE PRODUCED IN SUPERSONIC FLOW. G. I. Taganov. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk 20, 383-94(1956) May-June. (In Russian)

Comparative studies of the resistance related to the lifting force produced on two wings of the same span and equal lifting force (one optimal for incompressible flow with elliptic circulation distributed along the span, and the other optimal one with flat trapezoid wings for supersonic velocities) show that at equal thrust force velocities the wing in supersonic flow still has π times more resistance than the wing in incompressible flow. Analytical studies were carried out to determine if both types of wing resistance in supersonic flow are mechanically essential factors for producing the lifting force and comprise a part of parasitic resistance pertaining to the principles of gas dynamics. (R.V.J.)

246

LAMINAR BOUNDARY LAYER OF COMPRESSED GAS ON A PLATE IN LARGE RANGE OF TEMPERATURE CHANGES. V. V. Lunev. Akad. Nauk S.S.S.R. Otdel Tekh. Nauk 20, 395-401(1956) May-June. (In Russian)

A laminar layer of compressed gas on a plate is analyzed without applying the simplification assumption of viscosity relation to temperature. The Prandtl number is accepted as constant or in slight dependence on temperature. The range of temperatures studied includes the air dissociation point (2000°K and over at standard pressures). A method of assumption sequences converging to an accurate resolution of the problem which is considered to be the only existing solution, is offered for a constant and wide range of boundary conditions. (R.V.J.)

247

COOLANT TECHNOLOGY OF A PRESSURIZED WATER POWER PLANT. Irving H. Welinsky and Paul Cohen (Westinghouse Electric Corp., Pittsburgh) and James H. Seamon (National Aluminate Corp., Chicago). Chem. Eng. Progr. 52, 388-93(1956) Sept.

The results of two year's operation of a pressurized water nuclear power plant are reviewed. Plant description, materials selection, purification system design, water technology, and plant performance are included in the discussion. (T.R.H.)

248

THREE-DIMENSIONAL BOUNDARY LAYER ON AN ARBITRARY SURFACE. V. V. Struminskiĭ. Doklady Akad. Nauk S.S.S.R. 108, 595-8(1956) June 1. (In Russian)

Equations were developed for a three-dimensional boundary layer on an arbitrary surface and it is shown that these equations represent the final form of the Navier-Stokes equations with unlimited increase in Reynolds number. The three-dimensional equations for the boundary layer were transposed in their appearance indicating the effects of strong main curves on the surface. For the surfaces with negligible variations of the main curves on the surface. For the surfaces with negligible variations of the main curves along the additional curve lines the general equations for the three-dimensional boundary layer may be transposed to the appearance coinciding with the equations for the three-dimensional layer in a flat lamina. (R.V.J.)

249

INEXPENSIVE WAY TO CONTROL OXYGEN IN SODIUM HEAT-TRANSFER SYSTEMS. I. L. Gray, R. L. Neal, and B. G. Voorhees (General Electric Co., Schenectady, N. Y.). Nucleonics 14, No. 10, 34-7(1956) Oct.

Sodium oxides in molten Na accelerate metal corrosion and plug systems in cold regions. Rugged, reliable devices were developed to measure 3 to 300 ppm O_2 in Na and NaK (200 to 700°F) and to reduce O_2 to less than 10. (auth)

250

EXPANSION OF TURBULENT GAS FLOW IN THE MEDIUM OF DIFFERENT DENSITY. L. A. Vulis and N. N. Terekhina. Zhur. Tekh. Fiz. 26, 1277-91(1956 June. (In Russian)

A free flow of turbulent gas into an area filled by gas of different density is studied and an approximate solution is given for the problem of the basic area of an axial-symmetric stream. Results are given for experiments made in a wide range of gas density ratios in a stream and in the surrounding medium. (tr-auth)

251

HEAT TRANSFER DURING CROSS FLOW THROUGH CYLINDRICAL RODS BY TWO-PHASE STREAM. R. Z. Alimov. Zhur. Tekh. Fiz. 26, 1292-1305(1956) June. (In Russian)

Studies are made of heat transfer from surfaces of heated metal rods during the cross-sectional flow of air containing minute droplets of water. Results showed the appearance of two states of transfer depending on the temperature of streamlined surface. Quantitative data are obtained for each state in condition of slow air flow. (R.V.J.)

252

ON THE METHOD OF DIVIDED COLORIMETRIC DETERMINATION OF LAMINAR GAS FLOW (OZONE DECAY REACTION). (Moscow Inst. of Chemistry). A. M. Markevich. Zhur. Fiz. Khim. 30, 735-51(1956) Apr. (In Russian)

Studies are made to determine the applicability of a divided colorimetric method for measuring the laminar flow with small Re coefficients. In the ozone decay reaction, the ratio obtained in statistical conditions, remained correct. Catalytic ozone decay promoted by silver oxide–barium peroxides at 40 to 50°C has a heterogenic process. Along with the exothermal process, the endothermal heterogenic process took place during ozone decay in quartz apparatus at the temperatures of 127 to 195°C. (R.V.J.)

MATERIALS TESTING

253 AD-25302

Wayne Univ., Detroit.

OUTLINE OF RESEARCH IN LIFE AND FATIGUE TESTING. Final Report [for] April 1, 1951–January 31, 1954. Dept. of Mathematics. Benjamin Epstein. 25p. Contract Nonr-451(00).

A research project on the statistics of life and fatigue testing was initiated at Wayne University. The principal

objective of the research was to develop statistical techniques of estimation and decision making which make maximum use of the information arising from life and fatigue tests. A characteristic feature of such tests is that information becomes available continuously and failures when they do occur are naturally ordered (e.g., in time). The research represents substantial progress in a field about which little was known two or three years ago. On the theoretical side fundamental work has been done in estimation and hypothesis testing, in stochastic processes continuous and ordinary sequential analysis, non-parametric theory, and order statistics. The research has stimulated interest in life testing and has drawn the attention of other mathematical statisticians to some of the important problems in this field. On the applied side it has been clear from the start that the results would be useful in fields as diverse as life testing of electron tubes to follow-up studies on the effectiveness of medical treatment. The potential applications are very numerous. (auth)

254 APEX-265

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

A BRIEF LITERATURE SURVEY RELATING TEMPERATURE TO BOUNDARY LUBRICATION PHENOMENA. A. D. Varanelli. Sept. 1956. 35p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.35(OTS).

255 WADC-TN-56-40

Brooklyn. Polytechnic Inst.

BIBLIOGRAPHY OF CREEP FOR STRUCTURAL ENGINEERS. Joseph Kempner and N. J. Hoff. Mar. 1956. 62p. Project title: STRUCTURAL TESTING OF ELEVATED TEMPERATURES, WADC PILOT PLANT. Contract AF33(616)-116. (AD-99183).

RADIOGRAPHY

256

NEUTRON RADIOGRAPHY. J. Thewlis (Atomic Energy Research Establishment, Harwell, Berks, England). Brit. J. Appl. Phys. 7, 345-50(1956) Oct.

The absorption of neutrons by matter is considered and neutron radiography is explained. The production and detection of neutrons are described and details are given of the techniques used for neutron radiography at Harwell. Some examples of neutron radiographs are reproduced and discussed. (auth)

WASTE DISPOSAL

257

HEAT PROBLEMS IN THE DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTES. E. A. Coppinger and R. E. Tomlinson (Hanford Atomic Products Operation, Richland, Wash.). Chem. Eng. Progr. 52, 417-21(1956) Oct.

The production of power by the fission of heavy elements gives rise to a new type of industrial waste—the radioisotope. This waste is unique in that it continuously generates heat by the decay of the fission products. This rate of heat generation is sufficient to create problems in the containment of these wastes and places practical limitations on the methods which may be employed. Up to the present time the only method demonstrated on a large scale is the semi-permanent storage of these wastes in buried tanks. Other disposal methods are in various stages of development but all suffer from severe limitations imposed by the self-heating characteristics of the wastes. The removal of cesium and strontium from the waste decreases markedly the time that the self-heating characteristic remains as a practical operating problem and paves the way for the eventual storage of the residual wastes by ion exchange in the soil in some arid, isolated location. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

258 NRL-4753

Naval Research Lab., Washington, D. C.

THIN FILMS OF POLYTETRAFLUOROETHYLENE RESIN (TEFLON) AS LUBRICANTS AND PRESERVATIVE COATINGS FOR METALS. Interim Report. V. G. FitzSimmons and W. A. Zisman. May 7, 1956. 32p. BuORD Project NO-461-209 and BuShips Project NS-067-009. (PB-121161).

Teflon, when applied as thin films to hard substrates, produces a dry, chemically resistant, all-weather lubricant which has remarkable preservative qualities. Its coefficient of friction, when sliding against another film of Teflon on a hard substrate is 0.04 to 0.05 through a temperature range of -50 to 230°C. In nearly every instance the applications have been carried from the laboratory through service tests in the military equipments. As a result of much experience in applying Teflon films to metal substrates, a number of essential techniques which insure minimum friction, maximum durability to prevent wear, good adhesion, and good corrosion-prevention properties have been developed. A summary is given of the experimental work and field tests on a number of applications of Teflon to guns and ammunition, submarines, aircraft, and miscellaneous applications. Because of its highly desirable and unique properties, Teflon coatings are recommended for lubricating and preserving ammunition for automatic guns, the mechanisms of small arms, a wide variety of mechanisms in submarines, parts of hydraulic and pneumatic systems of ships and aircraft, titanium nuts and bolts to prevent galling and seizing, a recently developed parachute release mechanism, many parts of the mechanisms of torpedoes, fuel pumps and fuel meters, oxygen regulators, surgical instruments, prosthetic devices, bearings, gear trains and shafts operated at low sliding speeds, optical instruments and controls including periscopes, and calculating and tabulating machines. Teflon coatings, when properly used are ideal in numerous lubrication applications of much value to the military and to industry. (auth)

CERAMICS AND REFRACTORIES

259 OSR-TN-56-459

Stanford Research Inst., Menlo Park, Calif.

PHASE DIAGRAM STUDIES OF THE ZIRCONIA–THORIA SYSTEM AND THE TITANIUM–ZIRCONIUM–OXYGEN SYSTEM. Technical Report No. IV. (Report No. 7). Pol Duwez and Eugene Loh. Sept. 4, 1956. 22p. SRI Project No. CU-1410. Contract AF18(600)-1499. (AD-97076).

The phase relationships in the zirconia–thoria system were investigated by x-ray-diffraction and dilatometric methods. The specimens were melted in air at the focus of a solar furnace. The existence of a cubic CaF_2 type solid solution was established for thoria concentration above 17.5 mole %. However, this solid solution is stable only at high temperature, and, after prolonged heating at 2000°C and below, decomposes into tetragonal zirconia (which during subsequent cooling undergoes the unavoidable tetragonal-monoclinic inversion) and a thoria-rich phase containing at least 99 mole % thoria. (auth)

260 WADC-TR-55-473

National Bureau of Standards, Washington, D. C. MEASUREMENT OF THERMAL EXPANSION OF CERMET COMPONENTS OF HIGH TEMPERATURE X-RAY DIFFRACTION. [Summary Report for] February 14, 1953 to September 14, 1955. Floyd A. Mauer and Leonard H. Bolz. Dec. 1955. 63p. Project title: CERAMIC AND CERMET MATERIALS. Contract AF33(616)-53-12. (AD-95329).

A high-temperature specimen mount for a commercial x-ray-diffraction unit was designed especially for accurate measurements at temperatures up to 1400°C. It has been used in making thermal expansion measurements on seventeen samples, most of which are refractory materials being considered for use in high temperature applications. In general, the precision attained is comparable to that attained with conventional dilatometers but the x-ray method is unique in that it can provide data on the expansion in different directions in anisotropic crystals when only a few grams of powdered material are available. There is a further advantage in that the expansion measured is that of the crystal lattice and is independent of effects such as hysteresis that are observed in polycrystalline bodies because of changes in the way the crystallites fit together. (auth)

261 AEC-tr-2611

THE DIELECTRIC STRENGTH OF METAL TITANATES OF GROUP II OF THE D.I. MENDELEEV PERIODIC TABLE FOR DIRECT AND ALTERNATING (f = 50 CPS) VOLTAGES. V. I. Sarafanov. Translated from Zhur. Eksptl'. i Teoret. Fiz. 27, 590-4(1954). 5p.

The breakdown voltage of titanates of Ba, Zn, Mg, Ca, and Sr, and Ba tetratitanate ranges from 2 to 4×10^5 v/cm. It is somewhat lower for Ba metatitanate. The breakdown of Zn, Mg, and Ca titanates under direct voltages and of all six under alternating voltage is electrical; The break down of Sr and Ba titanates and probably of Ba tetratitanate is thermal under a direc. voltage. (T.R.H.)

262 AEC-tr-2624

FERROELECTRIC PROPERTIES OF SOLID SOLUTION OF BARIUM STANNATE IN BARIUM TITANATE. G. A. Smolenskiĭ (Smolensky) and V. A. Isupov. Translated from Zhur. Tekh. Fiz. 24, 1375-86(1954). 12p.

Volume electrostriction, dielectric permeability, elastic modulus, resonance frequencies, and other ferroelectric properties of solid solutions of $BaSnO_3$ in $BaTiO_3$ are studied. (T.R.H.)

263

AN OXIDATION STUDY OF COBALT–ALUMINA MIXTURES. W. B. Crandall and R. R. West (Alfred Univ., N. Y.). Am. Ceram. Soc. Bull. 35, 66-70(1956) Feb. 15.

264

HIGH DIELECTRIC PERMEABILITY OF NIOBATES AND TANTALATES OF DIVALENT METALS. G. A. Smolenskiĭ, V. A. Isupov, and A. I. Agranovskaya (Inst. of Silicate Chemistry). Doklady Akad. Nauk S.S.S.R. 108, 232-5(1956) May 11. (In Russian)

Samples of niobates and tantalates were synthesized by the usual method. The porosity of the specimens did not exceed 1.5%. The tabulations and structural data for the experiments are presented. Results show that all niobates and tantalates except for metaniobates, metatantalates, and pyroniobates of calcium, have a high dielectric permeability and negative temperature coefficient. Some niobate and tantalate specimens showed considerable dielectric losses which can be explained by their high electronic conductivity. (R.V.J.)

265

MATERIALS OF CONSTRUCTION—CERAMICS. Lane Mitchell (Georgia Inst. of Tech., Atlanta). Ind. Eng. Chem. 48, 1702-9(1956) Sept.

A review of the year's progress in fundamental and general ceramic research, ceramics in electronic applications, and applications of ceramics in nuclear energy production is given. (F.S.)

266

SINTERING AND GRAIN GROWTH OF ALPHA-ALUMINA. Harold P. Cahoon and Carl J. Christensen (Univ. of Utah, Salt Lake City). J. Am. Ceram. Soc. 39, 337-44(1956) Oct.

The sintering (densification) and grain growth of alumina were studied to determine the effect of the variables raw material, particle size, grinding in acid media, molding pressure, various single additives in different amounts, and firing temperature. Fine grinding promoted sintering and the growth of large grains and caused the grains to be more elongated in habit. Sintering was facilitated by additions of iron oxide, manganese oxide, copper oxide, and titanium oxide, provided the amounts of these oxides and the temperature of firing were within certain bounds. The growth of large grains was facilitated by additions of iron oxide and manganese oxide. Nineteen other additives had no effect or retarded sintering and large-grain growth. Both magnesium oxide and silica had a marked effect in inhibiting the growth of large grains. The alkali metal oxides, added singly, were especially deleterious to the production of strong alumina bodies. The maximum density and maximum strength of the fired body were attained approximately simultaneously with the onset of large-grain growth. The habit of the large grains was markedly altered by increasing amounts of each additive; the grains lost their characteristic crystalline shape and became nearly spheroidal particles. It is suggested that two grain-growth phenomena exist which are independent of each other. One is termed "small-grain growth" and is associated with densification; the other is referred to as "large-grain growth" and occurs in certain specimens, depending on the additions to the alumina, after the sintering (densification) is substantially complete. (auth)

267

PRODUCTION OF MOLTEN TANTALUM CARBIDE. V. I. Smirnova and B. F. Ormont (Karpov Inst. of Physical Chemistry). Zhur. Obshcheĭ Khim. 26, 958-60(1956) Apr. (In Russian)

Experiments are described for preparation of molten TaC so as to avoid the thermal dissociation of the carbide and exclude the impurities from the apparatus materials and gases. The electrical scheme of the installation used in producing the molten drops or lumps of these high-melting-point materials is presented. (R.V.J.)

CORROSION

268 AECU-3355

Ionics, Inc., Cambridge, Mass. ANALYSIS OF CORROSION PRODUCTS FROM WAPD LOOP TEST. Work Performed October–November 1953. J. A. Marinsky, C. M. Cobb, A. E. Baker, A. L. Carney, and J. J. Fitzgerald. Dec. 15, 1953. 22p. For Westinghouse Electric Corp. Atomic Power Div. $4.80(ph OTS); $2.70(mf OTS).

The analyses and methods of analysis are given for filter crud, loop water, and resin bed samples from WAPD loop tests. (T.R.H.)

269 AERE-M/M-116

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CORROSION OF MILD STEEL BY HIGH TEMPERATURE WATER. J. N. Wanklyn. May 1956. 8p.

Methods of measuring and expressing the corrosion of carbon steel by high temperature H_2O are discussed. Recent information on the influence of a number of factors is summarized. (auth)

270 HW-41370

[Hanford Atomic Products Operation, Richland, Wash.]

327 BASIN ALUMINUM CORROSION TEST. G. R. Mallett. Feb. 9, 1956. 8p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

An investigation of corrosion in the 327 Building's water storage basin was made to determine whether the static storage of Al jacketed fuel elements could cause corrosion effects that would interfere with studies of in-pile corrosion. It was determined that the amount and type of corrosion which occurs in the 327 Building basin does not interfere with the examination for Al corrosion on irradiated slugs, and that the use of $NaNO_3$ as a corrosion inhibitor was not necessary in the prevention of excess aluminum corrosion on slugs stored in the basin. (auth)

271 HW-42884

Hanford Atomic Products Operation, Richland, Wash.

FIELD CORROSION TESTS IN PUREX ACID URANIUM AND WASTE CONCENTRATORS. N. D. Groves and K. M. Haws. June 28, 1956. 10p. Contract W-31-109-Eng-52. $0.15(OTS).

A program for field corrosion tests in Purex acid, uranium, and waste concentrators using small heat exchangers is presented. (T.R.H.)

272 HW-44837

[Hanford Atomic Products Operation, Richland, Wash.].

SAFE CONDITIONS FOR APPLYING TITANIUM IN H.A.P.O. PROCESS EQUIPMENT. R. E. Smith. Aug. 6, 1956. 7p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Laboratory investigations and industrial experience indicate HNO_3–Ti systems are not explosive if the HNO_3 contains more than 2% H_2O. (D.E.B.)

273 JPL-PR-26-1

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

CORROSION AND IGNITION OF TITANIUM ALLOYS IN FUMING NITRIC ACID. I. STUDY OF SOME CHEMICAL AND METALLURGICAL FACTORS. Progress Report. John B. Rittenhouse, Stephen P. Vango, and David M. Mason. Sept. 30, 1955. 28p. Contract AF33(616)-3066.

The corrosion behavior and tendency for ignition of commercially pure Ti and the alloy containing 7% Mn when stored in liquid-phase fuming HNO_3 at 30°C (86°F) were studied. The tendency for stress-corrosion cracking of these alloys increases with NO_2 content in the range 0 to 20 wt. % and decreases with an increase in H_2O in the range 0 to 3 wt. %. Ignition of these alloys can be initiated in situ by impact or probing after exposure to fuming HNO_3 for periods of time as low as 24 hours. Susceptibility to ignition appears to be dependent on there being from 10 to 20% NO_2 and less than 1.5 wt. % H_2O in the acid. The ignition phenomenon is associated with a chemical change in the surface of the metal itself, which is observed to darken. This conclusion was drawn from the observation that upon removal from the fuming HNO_3 and washing, the metal can be ignited by probing in air or upon immersion in fresh acid. (auth)

274 JPL-PR-26-4

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

CORROSION AND IGNITION OF TITANIUM ALLOYS IN FUMING NITRIC ACID. IV. STUDY OF ADDITIONAL TITANIUM ALLOYS. Progress Report. John B. Rittenhouse and Julia S. Whittick. Mar. 30, 1956. 24p. Contract AF33(616)-3066.

The corrosion-time curve of the Ti–8% Mn alloy follows initially a power-function law; a linear law is followed in the later stages of corrosion. Corrosion rates, ignition sensitivity, and stress corrosion cracking of titanium alloys A55, Ti 100A, Ti 140A, Ti 6 Al–4V, and A 110AT were studied. Storage tests for thirty days at 30°C of several Ti alloys in thermally stable fuming HNO_3 (13% NO_2–2% H_2O) were completed. (auth)

275 NP-6138

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF OXIDATION AND LIQUID SODIUM RESISTANT BRAZING ALLOYS. Quarterly Report No. 1 [for] July 15, 1956 to October 15, 1956. Domenic A. Canonico and Harry Schwartzbart. Oct. 22, 1956. 20p. Project No. B 110. Contract AF33(600)-33406.

Progress is reported on developing oxidation and liquid Na resistant brazing alloys and a simple ductility test for brazed joints. Three base metals have been selected: Cr, Fe and Ni. Various temperature depressants, selected on the basis of their binary eutectics formed with one of the above three metals, are being alloyed with one or more of the above elements in the effort to obtain a brazing alloy having a flow temperature within the range of 1750 to 1900°F plus the oxidation and liquid Na resistance necessary. A technique is being studied that may permit the evaluation of ductility of a brazed joint. It is felt that the joint design and method of loading simulate service loading to the extent that significant values of ductility will be obtained, permitting the prediction of service behavior. The specimen is sectioned from a T-specimen and loaded in a tensile machine so that a fillet is subjected to tensile stresses similar to those in service. Preliminary examination of the method indicates some promise. (auth)

276 NRL-4824

Naval Research Lab., Washington, D. C.

SOLUBILITY AND THE PRODUCTS OF REACTION BETWEEN IRON AND WATER AT 26°C AND 300°C. Final Report. V. J. Linnenbom, J. I. Hoover, and H. S. Dreyer. Aug. 7, 1956. 15p.

The Fe content of saturated solutions resulting from the Fe-water reaction in the absence of O was obtained at 300°C using a radioactive tracer technique and at 26°C by spectrophotometric analysis. In both methods it was found necessary to filter the solution to remove undissolved solids. In addition, in the 300°C experiments, reproducibility of results was obtained only when the sample of saturated solution was separated from undissolved solid at the temperature and pressure of the experiment, and the sampling process did not disturb the equilibrium between solid and saturated solution by changes in temperature or pressure during sampling. After an initial increase over the first day or two, the concentrations of soluble Fe species at both temperatures were found to decrease with time. This was presumably due to increased filtering efficiency as the colloidal undissolved particles increased in size with ageing. However, the possibility of this decrease being due to a change in the nature of the solute species with time was not eliminated. At 300°C, after 23 days contact between the Fe and water, the Fe concentration appeared to approach a lower limit of 0.05 ppm Fe and the only product of reaction found was magnetite,

Fe_3O_4. Experiments at room temperature in the absence of O indicate that the primary product of the reaction is $Fe(OH)_2$. After 4 days contact between Fe and water, a solubility value of 0.41 ppm Fe was found; after 42 days contact, this had decreased to 0.08 ppm Fe. No Fe_3O_4 was found when the reaction took place at room temperature; appearance of Fe_3O_4 in the system was first found at temperatures between 50 and 60°C. The soluble iron concentration at 60°C was found to be 0.008 ppm Fe after 10 days contact between Fe and water. Although the project was terminated before sufficient data had been obtained to form any conclusions as to the reaction mechanisms, the results suggest other lines of attack which might further clarify the general problem of corrosion of iron in aqueous media, which is of particular interest in reactor technology. (auth)

277 RAE-TN-MET-219

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

CORROSION AND STRESS CORROSION PROPERTIES OF ALUMINIUM–COPPER AND ALUMINIUM–COPPER–CADMIUM ALLOYS. C. Braithwaite. Nov. 1955. 10p. (AD-91930).

The corrosion resistance of Al–Cu and Al–Cu–Cd alloys was investigated with and without stress after heat treatment to obtain the maximum tensile strength. Both alloys had high corrosion resistance under intermittent seawater spray conditions with and without stress. Safe stress of over the 0.19 proof stress was maintained 18 months. When exposed without load for 18 months neither of the alloys lost any tensile strength. (W.L.H.)

278 WAPD-T-238

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EFFECT OF PRIOR CORROSION HISTORY ON THE CORROSION OF ZIRCALOY-2 IN HIGH TEMPERATURE WATER. D. E. Thomas and S. Kass. June 22, 1955. 22p. Contract AT-11-1-GEN-14. $4.80(ph OTS); $2.70(mf OTS).

The corrosion of Zircaloy-2 is characterized by a transition from an initial quasi-cubic rate law to a linear rate law which occurs at very long exposure times at temperatures in the neighborhood of 600°F. The linear corrosion rate subsequent to the transition can be determined at low temperatures in a short time by transferring the specimen to the low temperature after having been exposed at higher temperatures for a time sufficient to reach the linear portion of the weight gain vs time curve. Such experiments are described together with transient effects which persist for a time after a specimen has been transferred from one temperature to another. (auth)

279 AEC-tr-2645

AN INVESTIGATION OF THE MECHANISM OF THE ACTION OF ANTI-CORROSION ADMIXTURES ON OILS BY THE METHOD OF RADIOACTIVE INDICATORS. Yu. (Iu.) S. Zaslavskiĭ, S. E. Krein, and R. N. Shneerova. Translated from Zhur. Fiz. Khim. 29, 1815-21(1955). 12p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 10-2041. (W.L.H.)

280

A BIBLIOGRAPHY OF CORROSION BY CHLORINE. Corrosion 12, 141t-8t(1956) Mar.

Abstracts of 86 papers on corrosion of various materials by chlorine are presented. (T.R.H.)

281

STRUCTURE OF OXIDE SCALES ON NICKEL–CHROMIUM STEELS. H. J. Yearian (Purdue Univ., Lafayette, Ind.); H. E. Boren, Jr. (Johns Hopkins Univ., Baltimore); and R. E. Warr (Diamond Ordnance Fuze Labs., Washington, D. C.). Corrosion 12, 561t-8t(1956) Nov.

The structure of the scales formed on a series of typical Ni–Cr steels when oxidized for 100 hours in air at temperatures from 1600 to 2200°F were investigated by x-ray-diffraction of methods. The scales are of two distinct types. The principal and definitive constituent of the more protective type is Cr_2O_3. A solid solution of Fe_2O_3–Cr_2O_3 also may be present; in such cases its Fe_2O_3 content tends to increase with attack rate at any given temperature. For very low attack rates considerable amounts of $MnCr_2O_4$ occur when the alloy contains a few tenths percent of Mn. As the attack rate increases this Mn–chromite spinel is replaced by a Ni–Cr–Fe spinel, the amount and the alloying element content of which increase with temperature and with the Ni level of the alloy. For an 80 Ni–20 Cr alloy, NiO is also present. When the attack rate becomes excessive the scale changes to a type containing no Cr_2O_3 phase but consisting of one or more Fe_2O_3–Cr_2O_3 solutions and Ni–Cr–Fe spinels. The ferric-chromic oxide solution tends to concentrate in the outer layer and it then contains less than 10 mole percent Cr_2O_3; the proportion may increase when it occurs in an inner layer. Spinels are present in all layers but their content of the alloying elements increases in the inward direction. These results are compared with existing data and interpreted using a theory of selective oxidation and depletion. (auth)

282

OXIDATION OF CHROMIUM SILICATE STEELS IN AIR AT ELEVATED TEMPERATURES. G. M. Orlova and V. V. Ipat'ev. Zhur. Priklad. Khim. 26, 819-28(1956) June.

Oxidation kinetics of steel with 6% Cr and 1.43, 1.86, and 3.34% Si at temperature range of 800 to 1200° were investigated. Results showed that the specimen of all melts contained an outer layer of Fe_2O_3, the middle layer of Fe_3O_4, and, so called, spinel–fayalite layer of $FeO \cdot Cr_2O_3$ and $2FeO \cdot SiO_2$; all of the Cr and Si were in that inner layer. It was shown that the break in the square overweight-time curves is due to the structural changes of the specimen; the thickness of Fe_2O_3 layer increases at the expense of the magnetic Fe_3O_4 and the spinel-fayalite layers. (R.V.J.)

Refer to abstract 329.

GEOLOGY AND MINERALOGY

283 CEA-484

France. Commissariat a l'Energie Atomique, Paris.

LA PROSPECTION DE L'URANIUM. (Prospecting for Uranium). Marcel Roubault. 1955. 64p.

The general methods of prospecting are surveyed, including a review of known geological fundamentals. The peculiarities of U prospecting are also briefly discussed. A summary description is given of the principle U-bearing minerals, and the use of the G-M counter to detect these minerals is discussed. The essential characteristics of U deposits are listed. (B.J.H.)

284 AERE-Lib/Trans-754

THE INFLUENCE OF THE ELECTROKINETIC PROPERTIES OF THE SURFACE OF MINERALS ON THEIR FLOTATION. V. M. Borisov. Translated by P. Collins from Doklady Akad. Nauk S.S.S.R. 99, 427-30(1954). 7p.

To ascertain the effect of individual reagents, which exist simultaneously in a flotation suspension, on minerals and on the characteristic of the amount of adsorption, it is convenient to use the value of the 'electrokinetic index' which shows itself in the difference between the electrokinetic potential of the surface in a solution of the first reagent and the electrokinetic potential after the introduction of a

second reagent into the same medium. For a true estimation of the mechanism of the influence of a reagent on the flotation activity of the surface of minerals, it is first necessary to study the nature of these reagents. The sign of the electrokinetic index determines how the ions are selectively adsorbed in the electrical double layer. The value of the ζ-potential of the surface of clean, mono-mineral powders by means of electroosmosis was ascertained. The change is shown of the ζ-potential and the electrokinetic index for apatite powder in relation to various concentrations of sodium carbonate with a constant content of solium oleate in the solution (50 mg/l). The same numerical laws are observed for other minerals. (auth)

285

X-RAY INVESTIGATIONS OF THE CRYSTAL STRUCTURE OF CHKALOVITE. Yu. A. Pyatenko, G. B. Bokii and N. V. Belov. Doklady Akad. Nauk S.S.S.R. 108, 1077-80(1956) June 21. (In Russian)

Chkalovite, $Na_2BeSi_2O_6$, is the rare mineral discovered in the alkali pegmatites in the Kol'skii peninsula in 1936. Its crystals have rhombohedral structure but of pseudo-tetragonal shape: two of the axes are equal within the error of the experiment, a = 21, 1 ± 0.1A, b = 21.1 ± 0.1A, and c = 6.87 ± 0.03A. X-ray analysis of diagonal facets showed central facets of orthogonal nuclei with F-lattices. By the specific gravity of the mineral (2.66) the number of unit cells in $Na_2BeSi_2O_6$ was established as 24. (R.V.J.)

286

THE PRESENCE OF URANINITE AS AN ADDITIONAL MINERAL IN GRANITE OF BAVENO. S. Deutsch and E. Picciotto (Universite Libre de Bruxelles). Experientia 12, 333-4(1956) Sept. (In French)

Microscopic crystals of uraninite are found in the accessories of the Baveno granite by the nuclear photographic emulsion technique. The uraninite is believed to be a primary mineral of the granite, its concentration in the sample is less than 1 p.p.m. but it contributes about 10% of the total α activity. (auth)

287

A^{40}–K^{40} DATING OF IGNEOUS ROCKS AND SEDIMENTS. G. J. Wasserburg (Univ. of Chicago) and R. J. Hayden and Kenneth J. Jensen (Argonne National Lab., Lemont, Ill.). Geochim. et Cosmochim. Acta 10, 153-65(1956) Sept.

The discrepancy in A^{40}/K^{40} ratios between micas and feldspars reported by Wetherill has been confirmed. Assuming no A^{40} to be inherited by potassium minerals, a branching ratio of 0.113 is calculated from dated mica samples. This implies that the micas investigated have retained 85% or more of their argon. The branching ratio of R= 0.085 is interpreted to be an empirical calibration constant which corrects for argon loss. The A^{40}/K^{40} ratios in four authigenic minerals have been determined and the ages are found to be in reasonable agreement with the times assigned to the geologic periods by Holmes. (auth)

288

STUDY OF THE RADIOACTIVITY OF METALLIC METEORITES BY THE PHOTOGRAPHIC METHOD. S. Deutsch (Laboratoire de Physique Nucléaire de l'Université Libre de Bruxelles); F. G. Houtermans (Institut de Physique, Berne); and E. E. Picciotto (Attachée à l'Institut Interuniversitaire des Sciences Nucléaires, Bruxelles). Geochim. et Cosmochim Acta 10, 166-84(1956) Sept. (In French)

289

ON VARIATIONS IN THE RELATIVE ABUNDANCE OF BORON ISOTOPES IN NATURE. A. Parwel and F. E. Wickman (Riksmuseet, Stockholm) and H. v. Ubisch (AB Atomenergi, Stockholm). Geochim. et Cosmochim. Acta 10, 185-90(1956) Sept.

The relative abundance of the B isotopes has been measured on forty-three samples of B minerals and sea-water. Contrary to an earlier investigation, no variations could be observed except for sea-water, where boron seems to be about 2% "heavier" than in the minerals. If variations do occur, they are less than a few parts per thousand. (auth)

290

THE RADIOACTIVE AGE OF FOUR WESTERN AUSTRALIAN PEGMATITES BY THE POTASSIUM AND RUBIDIUM METHODS. P. M. Jeffery (Carnegie Institution of Washington, D. C.). Geochim. et Cosmochim. Acta 10, 191-5 (1956) Sept.

Age determinations using the K-A and Rb-Sr decay schemes have been made on mica and feldspar minerals from several Western Australian pegmatitic intrusions. The results suggest that Rb-Sr and K-A ages determined on micas generally yield consistent ages, although a case of low mica K-A age is reported. The K-A ages of the feldspars measured appear to be considerably lower than their corresponding Rb-Sr ages, but again an exception is noted. It is concluded, using particular values of decay-constants and K branching ratio, that the four pegmatites dated are contemporaneous, with an age of some 2800 million years. (auth)

291

SEPARATION OF ALUMINUM PHOSPHATE MINERALS FROM KAOLINITE BY SELECTIVE SOLUTION. Irving May and Roberta Smith (U. S. Geological Survey, Washington, D. C.). J. Assoc. Offic. Agr. Chemists 39, 766-8(1956) Aug.

Aluminum phosphate minerals may be separated from kaolinite by boiling in (1 + 1) HCl solution for 20 min. This should prove valuable in prospecting and beneficiation studies. (T.R.H.)

292

ON THE NUCLEAR PHYSICAL STABILITY OF THE URANIUM MINERALS. P. K. Kuroda (Univ. of Arkansas, Fayetteville). J. Chem. Phys. 25, 781-2(1956) Oct.

An attempt is made to apply the nuclear reactor theory in geochronology and to explain certain interrelations between the age and the nuclear physical stability of the U minerals, as well as the geological environments of the mineral formation. (auth)

293

PROBLEMS IN PROSPECTING FOR RADIOACTIVE MINERALS AND THE INSTRUMENTS USED. J. Berbezier and C. Lallemant. L'Onde Electrique 35, 916-28(1955) Oct. (In French)

The general considerations on the detection of radiations are surveyed. Radiation detectors for both surface and depth work are described briefly. Mine γ meters are discussed briefly. The materials used for the determination and concentration of radioactive minerals are also discussed. (B.J.H.)

294

MEASUREMENT OF FOSSIL AGES BY NATURAL RADIOCARBON (C^{14}) METHOD. J. Labeyrie (Commissariat a l'Energie Atomique, Paris). L'Onde Électrique 35, 1084-93(1955) Nov. (In French)

295

RADIOACTIVE FLUORSPAR DEPOSITS. Günter Zeschke. Neues. Jahrb. Mineral. Monatsh., No. 3, 59-67(1956) Mar. (In German).

296

INTRUSIONS OF RARE ELEMENTS IN ROCKS. L. V. Tauson. Priroda 45, 16-23(1956) July. (In Russian)

Distributions of rare elements and minerals in extrusion rocks, their ion radius, and isomorphic structure are reviewed. (R.V.J.)

297

GENETIC TYPES OF MINABLE URANIUM DEPOSITS. D. Ya. Surazhsky. Soviet J. Atomic Energy, No. 2, 221-9 (1956).

A survey is given of the various types of minable U deposits. (B.J.H.)

298

PROSPECTING AND DETECTION OF RADIOACTIVE MINERALS AND ORES. Günter Zeschke. Z. Erzbergbau u. Metallhüttenw. 9, No. 2, 1-8(1956). (In German).

299

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 6. GEOLOGY OF URANIUM AND THORIUM. New York, United Nations, 1956. 825p. $9.00.

METALS AND METALLURGY

300 AD-1698

Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATIONS OF RHENIUM. I. A SURVEY OF THE LITERATURE. Quarterly Report No. 1 for the Period June 23 to September 22, 1952. (Technical Report No. 1). C. T. Sims and E. N. Wyler. Nov. 7, 1952. 170p. Contract AF33(616)-232.

A literature survey on the physical and metallurgical properties of Re was made. Information was classified into history, occurrence, recovery, production, and physical, chemical, electronic and metallurgical properties. Chemical information was found to be abundant, but physical-constant data were extremely scarce. The physical metallurgy of Re is virtually an unexplored field. (F.S.)

301 AD-89984

Sintercast Corp. of America, Yonkers, N. Y.

RESEARCH ON HEAT RESISTANT ALLOYS STRENGTHENED AT ELEVATED TEMPERATURES BY INCORPORATION OF FINE PARTICULATE SUBSTANCES. Interim Report No. 1 [for] November 17, 1955 through January 16, 1956. Martin Epner and Claus G. Goetzel. Feb. 15, 1956. 13p. Contract NOas 56-227-C.

In a development program for reinforced metal products based on heat resistant alloys, ultrafine particulate substances are to be incorporated into a ductile matrix in such a distribution as to give optimum inhibition to creep and slip at elevated temperatures. Experiments have been initiated and apparatus procured to employ fine Nichrome and titanium carbide powders as starting materials in the powder metallurgy manufacture of the reinforced metal product. (auth)

302 AD-91625

Ohio State Univ. Research Foundation, Columbus.

FATIGUE TESTS OF TITANIUM ALLOY AND SAE 4340 STEEL SPECIMENS. Final Technical Report — Part 4. (Report No. 34). W. L. Starkey and J. A. Collins. Jan. 23, 1956. 55p. RF Project 518. Contract AF33(616)-209.

The effects of fretting-fatigue damage on the fatigue endurance limit of Ti 140-A titanium and SAE 4340 steel are reported. Primarily two variables were investigated. One was fretting pressure and the second was number of fretting cycles. The tests were performed on rotating-beam fatigue testing machines equipped with Prot loading attachments. It was found that Ti is in general more sensitive to fretting than is steel. Titanium also exhibits more scatter in the test data than does the steel. A decrease in endurance limit is observed when either the fretting pressure or number of fretting cycles is increased. (auth)

303 AERE-CE/M-172

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A METAL VACUUM FURNACE FOR THE MELTING OF METALS BY RADIO FREQUENCY HEATING. F. Roberts and B. T. Bell. June 1956. 13p.

A description is given of the use of a valve oscillator in conjunction with a metal vacuum furnace for melting metals. Topics such as selection of design for the vacuum furnace and typical operation of the vacuum furnace are included. The furnace is suitable for the vacuum melting of metals such as Cu, steel, and U. (J.H.M.)

304 AGC-AE-16

Aerojet General Corp., Azusa, Calif.

THE REACTION OF MOLTEN METAL WITH WATER. Monthly Progress Report [for] February 1 through February 29, 1956. Mar. 29, 1956. 13p. Contract AT(04-3)-44. (AGC-L2914-15). $3.30(ph OTS); $2.40(mf OTS).

The proposed study of the reactions of molten metals with water is discussed. The high-temperature oxidation of Ta is reviewed. The equipment, theory, and metals to be studied are outlined. (W.L.H.)

305 BMI-1096

Battelle Memorial Inst., Columbus, Ohio.

AN EXPERIMENTAL SURVEY OF THE HEAT-TREATMENT RESPONSE OF SOME ZIRCONIUM–URANIUM ALLOYS. Henry A. Saller, Frank A. Rough, and Walston Chubb. June 14, 1956. Decl. Sept. 28, 1956. 30p. Contract W-7405-eng-92. $0.35(OTS).

The heat-treatment behavior of Zr alloys containing 7 to 70 wt. % U is described. The effect of O contamination on the structure and hardness of these alloys is outlined. It is shown that in the initial stages of transformation of beta Zr–U solid solution into the low-temperature phases a potent hardening reaction occurs in alloys containing 20 to 70 wt. % U. In this reaction the hardness may rise from 200 DPH characteristic of retained beta to values in excess of 400 DPH. Practical heat treatments have been developed which produce relatively soft alloys. The microstructures and hardnesses produced by these treatments are shown. (auth)

306 BMI-1134

Battelle Memorial Inst., Columbus, Ohio.

THE CONSTITUTION OF DELTA-PHASE ALLOYS OF THE SYSTEM URANIUM–MOLYBDENUM–TITANIUM. Henry A. Saller, Frank A. Rough, Arthur A. Bauer, and J. Robert Doig. Sept. 25, 1956. 16p. Contract W-7405-eng-92. $0.20(OTS).

An investigation of the phase relationships between the δ phases of the U–Mo and U–Ti systems was conducted by studying alloys ranging in composition from U–31.5 at. % Mo to U-34 at. % Ti. A ternary cut showing these phase relationships is presented upon the basis of thermal-analysis data obtained and upon the basis of metallographic and x-ray examination of heat-treated and quenched specimens. Isothermal ternary sections, inferred from phase relationships determined between the two δ phases, are presented for the U–Mo–Ti system. In the compositional range investigated, and gamma–U solid solution exists at elevated temperatures. At about 900°C the delta U_2Ti phase, with limited Mo solubility, forms. Epsilon, a Mo–Ti-rich solid solution appears at the same temperature and appears in all phase regions that exist below this temperature except in the terminal δ-phase regions. The γ-phase is stable to approximately 660°C in Ti–rich alloys; the γ and δ U_2Ti phases decompose at this temperature to alpha U in a peritectoid reaction. The γ phase in Mo-rich alloys decomposes in an apparent eutectoid reaction, at about 593°C, to the delta-U–Mo and alpha–U phases. The

ϵ phase, while present, presumably plays a negligible role in these reactions. Titanium was found to markedly decrease the stability of retained γ in these alloys. Age-hardening characteristics developed in Ti-containing U–Mo alloys quenched from 900°C and aged at 500°C are ascribed to decomposition of gamma to the alpha and epsilon phases. (auth)

307 CAL-39

Cornell Aeronautical Lab., Inc., Buffalo.

LIMITING HIGH TEMPERATURE CREEP AND RUPTURE STRESSES OF SHEET ALLOYS FOR JET APPLICATIONS. G. J. Guarnieri and J. Salvaggi. Sept. 28, 1951. 51p. Project Squid. Contract N6ori-119. (DD-420-A-39; ATI-122296).

The high-temperature creep and fracture stresses have been determined for 24 alloys in sheet form over the range of service temperatures and times of interest to designers of jet aircraft parts. Included are steels representative of the low alloy ferritic and austenitic stainless types, Co base alloys, Inconel X, 24S–T3 alclad Al and FS-1H Mg. While the data presented were obtained from a single heat for each material, they provide a design basis for efficient utilization of sheet alloys in high temperature service. (auth)

308 CF-56-8-214

Oak Ridge National Lab., Tenn.

FAILURES OF TITANIUM ALLOY TRIM IN HRP DUMP VALVE LOOP. Joseph P. Hammond, T. M. Kegley, Jr., and G. M. Adamson. Aug. 15, 1956. 23p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

The failures resulted from rapid burning of the trim material, which occurred, probably on opening the valve, during a single cycle operation. (W.L.H.)

309 CF-56-10-36

Oak Ridge National Lab., Tenn

ALLOYS AND COMPOUNDS OF NIOBIUM. John P. Page. Oct. 8, 1956. 26p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A compilation of data on Nb and its compounds and alloys as reported in unclassified literature is presented. (J.E.D.)

310 CF-56-10-76

Oak Ridge National Lab.,Tenn.

CORRELATION OF CREEP AND RELAXATION TESTS ON INCONEL. F. A. Field. Oct. 15, 1956. 7p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

It has been proposed that plastic strain is the criterion for failure of a material subjected to thermal or strain cycling. In order to establish the amount of plastic strain induced by thermal loading the relaxation characteristics of the material cycled must be known. Detailed relaxation data are also of value in determining the basic parameters of a thermal cycling test program and in interpreting the results of such a program. Since creep data are so readily available it is of some practical importance to be able to describe the relaxation of a material from its creep properties. Several techniques for doing this have been developed, and the purpose here is to describe briefly one of these methods and compare its results with experimental data. (auth)

311 IGR-TN/C-370

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.

TRANSFORMATION HYSTERESIS IN URANIUM–½ At. % MOLYBDENUM ALLOY. R. Doldon. Sept. 25, 1956. 16p.

Results indicate that the isothermal T.T.T. diagram for transformation of β U in a ½ at. % Mo alloy is of single C type, the transformation occurs most rapidly in the range 450 to 520°C, the transformation mechanism is nucleation and growth, the finest grain size is obtained by isothermal transformation just below the "nose" of the C curve, i.e., in the range 400 to 450°C, continuous cooling of the β phase from 700°C results in a depression of the $\beta \rightarrow \alpha$ phase change temperatures with increasing rates of cooling, continuous cooling of the γ phase from 800°C results in a more rapid depression of the $\gamma \rightarrow \beta$ phase change temperatures, and a slight further depression of the $\beta \rightarrow \alpha$ change in addition to that which would occur on cooling from the β and fast cooling rates (> 150°C/minute) may result in a direct transformation from γ to α. (auth)

312 ISC-720

Ames Lab., Ames, Iowa.

PREPARATION OF ZIRCONIUM FROM ZIRCONIUM TETRAFLUORIDE. C. J. Baroch and G. H. Beyer. May 31, 1956. 18p. Contract W-7405-eng-82. $0.20(OTS).

Experimental bomb reductions of ZrF_4 with Mg were carried out. A charge of 350 g of ZrF_4, 105 g of ZnF_2, and 142 g of Mg gave good metal recovery and good metal-slag separation. Reaction of the ZnF_2 with Mg furnished the additional heat needed to melt the slag. The Zn–Zr alloy formed melted at about 1000°C, while the MgF_2 slag melted at about 1250°C. After dezincing, the Zr sponge was melted and its hardness measured. Hardness values of 62 on the Rockwell A Scale indicated the probable presence of impurities. With more stringent control of the purity of the reactants and by the use of larger bombs, it should be possible to produce higher purity Zr by this method. (auth)

313 LM/TAB-1

Mine Safety Appliances Co., Callery, Penna.

LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR THE PERIOD JULY 1 TO AUGUST 31, 1956. Sept. 7, 1956. 15p.

The first of a series of abstracts covering current literature on liquid metals is presented. (J.E.D.)

314 NACA-TN-3787

Pittsburgh. Univ.

HEAT-CAPACITY MEASUREMENTS OF TITANIUM AND OF A HYDRIDE OF TITANIUM FOR TEMPERATURES FROM 4° TO 15°K INCLUDING A DETAILED DESCRIPTION OF A SPECIAL ADIABATIC SPECIFIC-HEAT CALORIMETER. M. H. Aven, R. S. Craig, and W. E. Wallace. Oct. 1956. 30p.

Results of heat-capacity measurements on samples of pure titanium and of a hydride of titanium are presented and compared with calculated results. The measurements were made using a special adiabatic specific-heat calorimeter which is described in detail. (auth)

315 NP-6106

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

ADDITIONAL ENGINEERING APPLICATIONS OF THE ABSOLUTE RATE THEORY TO THE CREEP OF LEAD. Technical Report No. LI. Mervin B. Hogan. June 1, 1956. 97p. Project No. NR-032-168. Contract N7-onr-45101.

The four-element mechanical model was employed as an analogue for the experimental creep curve shown. The general experimental creep curve can be conveniently resolved into the three component curves when the tertiary creep is disregarded. The uniform slippage of the dashpot K, α as a function of time is indicated. The transient elongation creep in terms of time, is given mechanically by the spring E_p and the dashpot K_p, α_p acting in parallel. The theory and the various algebraic relations herein utilized have been published. The details of the analytical method have also been discussed. (auth)

316 NP-6130

Driver-Harris Co., Harrison, N. J.

DEVELOPMENT OF PRACTICES FOR COMMERCIAL PRODUCTION OF TITANIUM AND TITANIUM ALLOY WIRE. First Annual Report. W. M. Higgins and H. D. McKinney. July 1, 1956. 15p. Contract DAI-30-069-505-ORD(P)-1597.

Additional experience has been gained in drawing alloys Ti-55A, RC-A55, and Ti–6 Al–4 V. Use of an oxide coat in drawing is giving some worthwhile results. Drawing of alloy A-110-AT is still difficult, but progress is being made. The vacuum annealing furnace has now been operated with full-capacity charges. Arrangement has been made for four thermocouples inside the sealed vacuum chamber to tell temperatures at various places in the charge. General magnitudes of heating rates and temperature gradients have been observed with both light and heavy charges. (auth)

317 NRL-4839

Naval Research Lab., Washington, D. C.

EFFECT OF BAKING ON DELAYED FRACTURE OF ELECTROPLATED ULTRA HIGH-STRENGTH STEEL. B. F. Brown. Sept. 6, 1956. 19p.

The merits of the various methods which are used to test electroplating embrittlement are discussed. Delayed fracture tests on notched tensile specimens were conducted to assess the relief of this embrittlement in ultra high strength by baking at 250°F after plating. For chromium-plated steel this relief was essentially complete after baking 24 hr. For cadmium-plated steel the relief was incomplete even after baking 200 hours. For zinc-plated steel little relief was seen even after baking 200 hr. (auth)

318 ORNL-2181

New England Materials Lab., Inc., Medford, Mass.

DEVELOPMENT AND TESTING OF VACUUM MELTED NICKEL–MOLYBDENUM ALLOYS WITH MINOR ALLOYING ADDITIONS. Final Report. O. Preston, N. J. Grant, and C. F. Floe. Oct. 18, 1956. 40p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 584. $0.30(OTS).

A series of five simple vacuum melted Ni–Mo alloys in which the Mo increased progressively from 17 to 36% is discussed. Air melted Hastalloy B was included for comparison purposes. The test program included (for 3 heat treatments) creep rupture tests up to about 500 hours at 1350, 1500 and 1650°F, room temperature tensile tests, and room temperature tensile tests after 100 hr exposure at 1500°F to determine the degree of embrittlement. Because of severe embrittlement at room temperature after high temperature exposure of these simple binary Ni–Mo alloys, two of the intermediate molybdenum compositions were selected and additions of Cr, Fe, V and Cb were made to determine the degree of stabilization conferred by these various addition elements. (auth)

319 RAE-TN-MET-235

Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.

THE CORROSION RESISTANCE OF BINARY MAGNESIUM–LITHIUM ALLOYS IN SHEET FORM. H. G. Cole. Feb. 1956. 8p. (AD-93596).

Corrosion tests by total immersion in 3% NaCl solution and by intermittent sea water spray have been made on sheets rolled from a series of binary Mg–Li alloys low in Na. Alloys containing up to 10% Li by weight had a corrosion resistance approximately equal to that of Mg–1.5% Mn alloy sheet and were equally well protected by conventional protective treatments. At Li contents of 12% and over, corrosion resistance fell rapidly. (auth)

320 TAM-105

Illinois. Univ., Urbana.

AN INVESTIGATION OF FATIGUE CHARACTERISTICS OF LEADED ALLOY STEELS. Final Report. G. W. Brock and G. M. Sinclair. Sept. 1956. 57p. Contract N-Ord-16417.

An investigation was made to determine the influence of small amounts of Pb on the tensile and fatigue properties of SAE 1018, 1045, 8620, 4140, and 4340 steel. Statistical methods were used to determine the mean fatigue limit and the mean fatigue life. It was found that the Pb had little influence on the tensile properties, and the mean fatigue limit of the leaded steel was only significantly reduced at ultimate strengths above 130,000 psi., the notch sensitivity of the steel being little effected. At stresses above the endurance limit, leaded SAE 1018 and 4140 tended to give longer fatigue lives on smooth specimens, but no information is available on the other steels or on notched specimens. (auth)

321 TML-53

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE HOT EXTRUSION OF TITANIUM AND TITANIUM ALLOYS. A. M. Sabroff and P. D. Frost. Sept. 24, 1956. 80p. Contract AF18(600)-1375.

The available information in published literature and Government research reports on the extrusion of Ti and Ti alloys, and also the information obtained in a survey of the companies currently extruding Ti are reported. Included are a discussion of the requirements of the aircraft industry for Ti extrusions and the progress of the extrusion industry in meeting these requirements. The extrusion practices currently employed for the production of Ti alloy shapes and tubes, and the problems encountered in tooling, lubrication, billet heating, and heat treating are described. A final section gives a general discussion of the mechanical properties of extruded Ti and Ti alloys and the uniformity and reproducibility of these properties. (auth)

322 TML-55

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE MEASUREMENT OF THE THERMAL STABILITY OF TITANIUM ALLOYS. F. R. Schwartzberg, W. D. Rahr, D. N. Williams, and R. I. Jaffee. Oct. 5, 1956. 33p. Contract AF18(600)-1375.

The effects of varying the thermal exposure of three Ti alloys on their room-temperature mechanical properties have been determined. Variables studied were stress and strain during exposure and the time and temperature of exposure. The effects of variations in hydrogen content and in surface contamination of the test specimen were also determined. Alloys studied were: Ti–2Mo–2Cr–2Fe; Ti–6Al–4V; and Ti–4Al–Mn. (auth)

323 WADC-TR-53-24(Pt. 2)

Cornell Aeronautical Lab., Inc., Buffalo.

INTERMITTENT STRESSING AND HEATING TESTS OF AIRCRAFT STRUCTURAL METALS. G. J. Guarnieri. Sept. 1954. 99p. Contract AF33(038)-10958. (AD-36036).

The high-temperature creep-rupture properties of six sheet alloys having application to aircraft design were investigated under conditions of intermittent load and temperature for comparison with their corresponding constant temperature-constant load behavior. Included are type 321 stainless steel at 1200 and 1350°F, N-155 alloy at 1350 and 1500°F, Inconel X at 1350 and 1500°F, RC-130-A Ti at 800°F, 24S-T3 clad Al at 300, 450, and 600°F, and FS-1H Mg at 300 and 450°F. Intermittent load–constant tempera-

ture tests were conducted with a cycle of one-hour-load-on, one-hour-load-off in most cases although several of the alloys were subjected also to an eight-hour-on, eight-hour-off load cycle. Intermittent temperature-constant load tests were made using a two-hour cycle with the specimen at temperature one hour and cooled one hour. While these relatively simple cyclic conditions do not duplicate the complex load and temperature patterns encountered in aircraft service, the results obtained do provide some qualitative guidance in applying available static creep-rupture data to design of aircraft structural parts. A wide variety of effects were produced by the intermittent load and temperature conditions. Stability of microstructure was one of the more significant variables controlling the alloy response to the cyclic conditions. Acceleration of creep and rupture was induced by intermittent loading where such processes as overaging, relaxation, recrystallization, and loss of ductility occurred. Retarding of creep and rupture occurred in those alloys where increase in ductility and creep recovery developed because of the intermittent-load cycle. Intermittent heating produced acceleration of creep and rupture in a number of cases, particularly where susceptibility to intergranular oxidation and cracking was aggravated by thermal stresses. (auth)

324 WADC-TR-53-190(Pt. 4)
American Electro Metal Corp., Yonkers, N. Y.
NEW HIGH TEMPERATURE INTERMETALLIC MATERIALS. Ronald Silverman. Mar. 1956. 48p. Project title: CERAMIC AND CERMET MATERIALS. Task title: HIGH TEMPERATURE AND HIGH STRESS CHARACTERISTICS OF CERAMICS AND CERMETS. Contract AF33(616)-109. (AD-93172).

The 100-hour stress-to-rupture life of alloy 223 (Cr–Mo–Si 81/16/3) at 1800°F is in the range of 30,000 to 40,000 psi. Impact resistance is low, however, materials with appreciable amounts of sigma in the Co–Cr–Mo system appear to be unsuitable for jet engine turbine blading due mainly to their low stress-to-rupture life at 1800°F and low impact strength at room temperature. "Pearlitic" structures and preferred precipitation patterns were observed in many alloys of this type. The "pearlitic" lamallae are believed to be due to carbide formation, while the preferred precipitation pattern is believed to be due to the sigma phase. Of the alloys tested in the Co–Zr, Ni–Zr, V–Fe, V–Co, V–Ni, V–Si, Mn–Co, Mn–Mo and Mo–Co systems, alloys in the Ni–Zr binary seem to have the most promise on the basis of oxidation resistance and ductility. X-ray patterns and photomicrographs were obtained for many of these alloys. (auth)

325 WADC-TR-54-384(Pt. I)
Massachusetts Inst. of Tech., Cambridge.
THE EFFECTS OF THERMAL RADIATION ON AIRCRAFT STRUCTURES. PART I. THE M.I.T. MARK I RADIANT HEATING STRUCTURAL TEST FACILITY. John C. Loria, William J. Blackstock, and James W. Mar. Oct. 15, 1954. 59p. Project title: ATOMIC WEAPON EFFECTS ON AIRCRAFT SYSTEMS. Contract AF33(038)-8906. (AD-84474).

A high-temperature radiation source, which measures 7- by 24-in. and utilizes Globar heating elements, has been constructed at the Aeroelastic and Structures Research Laboratory, Massachusetts Institute of Technology, for the exposure of aircraft structural components to high intensity radiation on one surface. Although designed primarily for the study of the thermal effects from an atomic explosion on aircraft structures, the radiant heater can be adapted to other problems, e.g., the uniform heating of all surfaces in aerodynamic heating and the static or dynamic loading of a specimen which is subject to high intensity radiation. The heater has a continuously variable operating temperature up to 3000°F, and at this peak temperature it delivers approximately 11.7 cal/cm^2 sec at a distance of three inches from the midplane of the source. Two hydraulic jacks provide vertical movement while the base is mounted on tracks to provide horizontal translation. A pneumatically operated injection shield insulates the model from the heat source and furnishes quick exposure to, and shutoff from the radiation. The Globar heating elements have shown a satisfactory operating lifetime. (auth)

326 WADC-TR-54-384(Pt. II)
Massachusetts Inst. of Tech., Cambridge.
THE EFFECTS OF THERMAL RADIATION ON AIRCRAFT STRUCTURES. PART II. THE RESPONSE OF A SIMPLE STRUCTURE TO RADIANT HEATING. Lucien A. Schmit and Francis L. Williams. Feb. 1, 1955. 78p. Project title: ATOMIC WEAPON EFFECTS ON AIRCRAFT SYSTEMS. Contract AF33(038)-8906. (AD-97527).

Theoretical and experimental methods are used to determine both temperature and stress responses for a thin-walled extruded beam of rectangular cross section which is exposed to radiant heating. The model cross section does not have any joints, and thus the difficulties which usually arise from joint contact resistance are avoided. Thermal buckling does not occur at the temperature and stress levels attained in the experimental work and is not considered in the theoretical analysis. A satisfactory correlation between theory and experiment is shown by a comparison of the respective temperature and stress time histories at eight points around the periphery of the beam. A need exists for further experimental work to establish the point at which existing theoretical methods become unsatisfactory. (auth)

327 WADC-TR-55-496
Battelle Memorial Inst., Columbus, Ohio.
THERMAL CONDUCTIVITIES, HEAT CAPACITIES, AND LINEAR THERMAL EXPANSION OF FIVE MATERIALS. C. F. Lucks and H. W. Deem. Jan. 18, 1956. 71p. Project title: WEAPON SYSTEM 107A AIRFRAME SUBSYSTEM. Task title: MECHANICAL, PHYSICAL, AND THERMAL PROPERTIES OF HIGH TEMPERATURE MATERIALS. Contract AF33(616)-2902. (AD-97185).

Thermal-conductivity measurements on Cu, Cr, Mo, Grade GBH graphite, and Grade 7087 graphite are reported for the temperature range of about 200 to 1700°F. Calibration of equipment to extend the measurements to 3000°F is presented. Heat-capacity measurements have been made on Cr, Mo, Grade GBH graphite, and Grade 7087 graphite from 32 to 3000°F, and on Cu from 32 to 1950°F. Measurements on the linear thermal expansions of Cr, Mo, Grade GBH graphite, and Grade 7087 graphite from 68 to 3000°F, and of Cu from 68 to 1800°F are reported. (auth)

328 WADC-TR-55-510
Cornell Aeronautical Lab., Inc., Buffalo.
INVESTIGATION OF STRESS RELIEF PROCEDURES FOR TITANIUM AND TITANIUM ALLOYS. Period covered: November 1, 1954 to December 31, 1955. Franklin J. Gillig. Aug. 1956. 81p. Project Title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2688. (AD-97200).

The causes and effects of residual stresses in titanium aircraft parts were critically examined and a means of reducing these residual stresses to a practical value by thermal treatments was evolved. A summary of residual stress effects and attempted residual stress measurements in titanium aircraft parts and experimental data on the effectiveness of various time-temperature combinations for stress relief of elastically restrained unalloyed and alloyed

titanium sheet are presented. The difference between macro and micro stresses is discussed and the relationship between these stresses and the properties of the material are pointed out. The method of setting up simulated residual stresses in a simple beam specimen and measuring their decay with time and temperature is described. Using this method, relaxation tests were made on four titanium compositions: A-55, C-110M, 6 Al–4 V and A-110AT. Three stress levels corresponding to the room temperature elastic limit and approximately 50 and 75% of the room temperature tensile yield strengths were imposed on the test specimens as simulated residual stresses. As a result of these tests, recommended stress relief treatments are given for the above alloys. (auth)

329 WADC-TR-56-242

Ohio State Univ. Research Foundation, Columbus.

STRESS CORROSION CRACKING IN TYPE 403 STAINLESS STEEL. [Period covered] March 1, 1955 to April 30, 1956. Mars G. Fontana. Aug. 1956. 58p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-2849. (AD-97215).

The effect of austenitizing temperature on the hardness, impact strength, and microstructure of Types 403, 420, and 431 stainless steel was determined. The optimum combination of these properties occurred with austenitizing temperatures of 1725, 1850 and 1900°F, respectively, for the 403, 420, and 431 materials. Tempered structures displayed minimums in the impact strength, tempering temperature curves at 1000, 900 and 1000°F for the 403, 420, and 431 materials respectively. Metallographic studies were made of stress-corrosion specimens tested in a 1 : 1 HCl and water solution containing 1% SeO_2. These studies showed that pitting was initiated at MnS inclusions and that cracking was associated with the pits. Also, pitting characteristics were dependent on tempering temperatures and therefore are related to the microstructure of the alloy. Cracking does not occur in the Type 403 alloy when it is tempered at 1050°F or higher. This temperature is lowered to 900°F for the Type 420 material, and it is less than 700°F for Type 431 stainless steel stressed to 75,000 psi and tested in the above solution. Electron microscopy and diffraction studies were made of tempered Type 403 stainless steel. These studies indicate several carbides to be present in the alloy after tempering in the 1000 to 1200°F temperature range. Diffraction patterns vary for specimens tempered in this range. (auth)

330 WADC-TR-56-343

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

STABILITY OF COMMERCIAL ALPHA-BETA TITANIUM ALLOYS. [Period covered] January 1955 to June 1956. Donald A. Wruck. July 22, 1956. 34p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. (AD-97214).

An investigation was undertaken to observe the influence of various factors such as temperature, time-at-temperature, stress, and H contamination on the stability characteristics of commercial α-β Ti alloys, as well as to gain an insight into the nature of the reactions responsible for the ductility loss in an unstable microstructure. Commercial alloys utilized in one phase or another in this program included Ti-150A, Ti-155A, Ti-140A, C-130AM, C-110M, Ti-6Al-4V, RS-140X, and 3Mn Complex. Tests show that in the absence of H contamination the α-β type alloys can be rendered quite stable up to the maximum temperatures at which they retain useful strength for stressed applications. The Ti-150A alloy loses a considerable amount of room temperature ductility after being exposed to 800°F for 200 hours and can subsequently be rendered ductile by annealing at 1200°F for 24 hours. Mechanisms of embrittlement are discussed, as well as the practical significance of stability. (auth)

331 WADC-TR-56-423

Library of Congress. Technical Information Div., Washington, D. C.

THERMAL PROPERTIES OF CERTAIN METALS. Period covered: July 1, 1955 to June 30, 1956. Thomas C. Goodwin, Jr., and Mauree W. Ayton. Aug. 1956. 269p. Project No. 2998. Contract AF33(616)-55-10.

This bibliography on the thermal properties of certain metals consists of references, with abstracts, to pertinent open literature published from 1920 to 1956, and to unclassified reports issued from about 1942 to 1956. The material included in the bibliography pertains to various thermal properties, namely, heat capacity, thermal conductivity, emissivity, thermal diffusivity, and thermal expansion of molybdenum, chromium, tantalum, graphite, and copper. (auth)

332 WAL-313/48

Syracuse Univ., N. Y. Metallurgical Research Labs.

SUMMARY OF STRENGTH LIMITATION PHENOMENA. Interim Technical Report No. 3 [on] THE EFFECT OF STRESS STATES AND CONCENTRATIONS ON PLASTIC FLOW AND FRACTURE. G. Sachs. July 1956. 31p. DA Project No. 5B93-26-006. Contract DAI-30-115-505-ORD-(P)-613. (MET-345-567T3).

Factors and effects which determine the limitations for the strength properties of various types of alloys are discussed. (J.H.M.)

333 WAL-401/97-35

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECTS OF INTERSTITIAL ELEMENTS ON WELDS IN ALPHA-BETA TITANIUM ALLOYS. Summary Report. W. J. Lewis, M. L. Kohn, and G. E. Faulkner. Mar. 31, 1956. 90p. Contract DA-33-019-ORD-1524.

Welding studies were conducted to determine the effects of the interstitial elements, C, N, and O on the mechanical properties of inert-gas metal-arc-welded joints in selected experimental alpha-beta Ti alloys. In practically all cases, these elements had a deleterious effect on the ductility and toughness of welds. The tolerance of the welded joints for interstitial elements was dependent on the types and composition of the alloys. Based on arbitrarily established limits, Ti-Fe alloys which contained over 1.5% Fe could not tolerate additions of interstitials above the sponge level (0.05% C, 0.011% N, and 0.092% O), but Ti-Mn and Ti-V alloys could tolerate interstitial additions. On the basis of alloys which contained Mn and V, maximum limits are recommended for alloys to be used in welding applications. The maximum limits, which are shown below, are not recommended to be applied in combination; that is, if any of the three interstitial elements are at the maximum limit specified, the other two interstitial elements should not be present in amounts exceeding the sponge level encountered in this investigation. A study also was made to determine the effects of H on the mechanical properties of Ti-Fe alloys. Deleterious effects were observed on the mechanical properties of the base metals and welds of the Ti–1.5Fe and Ti–3.0Fe alloys due to added H. The tests indicated that 150 ppm H can be tolerated in these alloys. Adverse effects were not observed in the Ti–3Fe–3Al alloy due to increasing H contents indicating that Al additions increased the tolerance of the Ti–Fe alloys for H. (auth)

334 WAL-401/267

Johns Hopkins Univ., Baltimore. Inst. for Cooperative Research.

CHARACTERISTICS OF D-C ARCS WITH TITANIUM

ANODES AND TUNGSTEN CATHODES IN INERT GAS SYSTEMS. Technical Report No. 1 [on] FUNDAMENTAL CHARACTERISTICS OF TITANIUM ARCS IN THE INERT GASES. T. Benjamin Jones and E. Howard Young. Mar. 1956. 66p. DA Project No. 593-08-021. Contract DAI-36-034-505-ORD-(P)-1 RD.

An experimental study of d-c arcs employing Ti electrodes in atmospheres of A, He and A–He mixtures was made in an attempt to determine the best procedures for welding Ti. Arcs over the current range of 2 to 200 amp were studied under carefully controlled laboratory conditions using a vacuum tight cell in which the gases could be maintained in an uncontaminated state at atmospheric pressure. The electrodes were mounted horizontally and consisted of Ti rods of various diameters as anodes and W rods of $\frac{1}{8}$ in. or $\frac{1}{4}$ in. as cathodes. Characteristics such as the variation of arc voltage with current, the variation of arc voltage with electrode separation, the melting rate of the Ti as a function of current, and the melting rate of the Ti electrodes as a function of electrode current density were measured. The results show that arcs in He were not nearly as consistent as for A. (J.H.M.)

335 WAL-691.1/44

Virginia. Univ., Charlottesville. Ordnance Research Lab.

DIRECT DETERMINATION OF THE ADHESIVE BOND STRENGTH OF CHROMIUM ELECTRODEPOSITED ON STEEL. Final Report. W. H. Dancy, Jr., and A. R. Kuhlthau. Feb. 1, 1955. 52p. DA Project 593-08-024. Contract DA-I-36-034-505-ORD-(P)-3. (UV-ORL-55-P3-TR-1; AD-90088).

Small chromium plated rotors have been freely suspended in a magnetic field and accelerated until the centrifugal forces acting on the plate cause it to be torn from the hardened steel base metal. A knowledge of the size of the rotor, the thickness and density of the coating and the speed of the rotor at failure allows one to compute directly the maximum stress imposed on the adhesive bond or other points of failure in the system as the case may be. A complete description of the apparatus is presented, and a test program involving a study of the effect of various surface treatments, both of cleaning and contaminating types, on the adhesion value is described. It is shown that the adhesion can be controlled by the use of prescribed contaminants. Further tests involving the effect of plate thickness and the length of use of plating bath on adhesion are described. The problem of the effect of the thickness of plated films on the tensile strength of steels having microstructures representative of the Martensitic, Bainitic, and Pearlitic systems was studied experimentally. (auth)

336 WAL-710/930-6

Syracuse Univ., N. Y. Research Inst.

HIGH IMPACT STRENGTH STEELS FOR LOW TEMPERATURE SERVICE. A. Hurlich. Aug. 19, 1955. 19p. (AD-86362).

The data were selected to show the progress which has been made to date in the development of low alloy nonstrategic steels having high toughness at subzero temperature when heat treated to yield strengths in the range of 100,000 to approximately 160,000 psi. Most of the steels employed for armor, gun tubes, recoilless rifles and various steel parts of ordnance equipment fall within this range of strengths and are considered high strength steels by ordnance standards. These strengths do not, however approach those of the ultra-high strength steels (200,000 to 240,000 psi yield strength) which are becoming of increasing importance in aircraft applications. (auth)

337 WAPD-A1W(PCh)-89

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

ADDITIONAL TEST RESULTS COVERING EFFECTS ON CARBON STEEL OF EXPOSURE TO REACTOR IRRADIATION AND HIGH TEMPERATURE, HIGH PRESSURE WATER. E. Lieberman. [1956]. 8p. $1.80(ph OTS); $1.80(mf OTS).

An addendum to WAPD-A1W(PCh)-39.

338 AEC-tr-2553

CONTRIBUTION TO THE STUDY OF BOUNDARIES AND SUBSTRUCTURES IN STEELS. L. Habraken and P. Cuvelier. Translated from Métaux (Corrosion-Inds.) 31, 105-25(1956). 26p.

It is shown that electron metallography makes an appreciable contribution to the study of boundaries and substructures. It gives new details on their structure and their reaction to chemical agents. It is indicated that in the majority of cases, these zones have their characteristic evolution both from a thermal and a mechanical point of view. The general results show that in steels, notably, the interpretation of the boundary demands a blending of the actual theory of the transition network and, in a modified form, the old theory of "cement," the latter being associated with the border encountered in numerous electron micrographs. (auth)

339 AEC-tr-2655

CALCULATION OF THE ACTIVITIES IN MAGNESIUM CHLORIDE–ALKALI–CHLORIDE MELTS FROM STRUCTURE MODELS. H. Flood and S. Urnes. Translated from Z. Elektrochem. 59, 834-9(1955). 19p.

The liquidus curves of the binary fusion diagrams of $MgCl_2$–AlkCl (where Alk = Na, K, or Rb) can be extensively explained by the assumption of a complex formation of the Mg^{+2} in the melt according to one of the two schemes a) (on the alkali side) $2Alk^+ + 2Cl^- + MgCl_2 = 2Alk^+ + MgCl_4^{-2}$ b) (on the magnesium side) $Mg^{+2} + 2Cl^- + 2AlkCl = 2Alk^+ + MgCl_4^{-2}$. The $MgCl_2$–NaCl diagram as a matter of fact induces a considerable thermal dissociation of the complexes in the melt. Furthermore it is shown that the course of the liquidus curve of the melt in equilibrium with the compound $KMgCl_3$ agrees quite well with the assumption that a complete dissociation according to the following scheme takes place during melting: $2KMgCl_3 = 2K^+ + Mg^{+2} + MgCl_4^{-2} + 2Cl^-$. (auth)

340 AEC-tr-2656

STUDIES ON BALL BEARING STEELS. II. EFFECT OF SOME METALLURGICAL FACTORS ON THE LIFE OF BALL BEARING STEELS. Bureau of Ships Translation 612. Manabu Ueno, Tetsutaro Mitsuhashi, and Yutaka Nakano—William K. Y. Tao and F. A. Raven, eds. Translated by William K. Y. Tao from Tetsu-to-Hagane 41, 1102-7(1955). 17p. Available from Science Translation Service, Univ. of Alabama, University, Ala.

The inner rings of ball bearings, whose life span was known by test, were studied, to search for the relationship between certain metallurgical factors and life span. Some of the factors tested were the chemical composition, nonmetallic inclusions, hardness, compressive loading on the inner ring, cementite content, grain size and degree of forging. The chemical composition had no direct relationship to the life of ball bearings. According to the findings, the carbon content of the domestic ball bearing steels was controlled in a higher range of the standard, but it must be controlled in a lower range also, to avoid segregation and coarse carbide. Chromium content must be controlled within 1.40 to 1.50%. Nitrogen content showed no clear relationship to the life of ball bearing steels. In one

group the N component had a relationship to the cementite content, whereas the other group revealed no such dependency. The higher the hardness resulting from subsequent heat treatment, the longer was the life span of the ball bearings. Hardness of the inner ring increased chiefly as a result of life-span tests. This increase of hardness was due to conversion of the retained austenite. Hardness resulting from life-span tests bears no relationship to the life duration. The compressive loading on the inner ring of the race had no direct relationship to the life of ball bearings. Non-metallic inclusions revealed scarcely any relationship to the life of ball bearings. With respect to the forging ratio, the domestic ball bearing steels were considerably below foreign grades. This factor must be raised by using a larger ingot. Cementite content retained after heat-treatment showed no clear relationship to the life of ball bearings. Maximum life-span was found to exist at a cementite content of approximately 6 to 8%. Grain size had no distinct relationship to the life of ball bearings. However, it was proven to have a relationship to the life-span, whereas the other did not. (auth)

341 AERE-Lib/Trans-614

ULTRAMICROSCOPIC INVESTIGATION OF THE FORMATION OF COLLOIDAL SYSTEMS IN ELECTROLYSIS AND THEIR ROLE IN THE ELECTRODEPOSITION OF METALS. M. N. Polukarov. Translated by R. C. Murray from Trudy Soveshchaniya Elertrokhim. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 488-93(1950) Dec. 19-25. 6p.

342 IGRL-T/W-17

THE TEMPERATURE DEPENDENCE OF THE ELASTICITY MODULUS OF PURE METALS. Werner Koster. Translated by M. W. Buxton from Z. Metallkunde 39, 1-9 (1948). 15p.

Measurement of the temperature dependence of the elasticity modulus of pure metals is discussed. Thirty-two metals of the highest purity, which had been annealed at a sufficiently high temperature before testing, were examined. The temperature range studied was −180°C to either 1000°C or the melting point of the metal. The results of the measurements are given. (J.H.M.)

343 IGRL-T/W-23

A PECULIAR PHENOMENON IN THE EFFECT OF TEMPERATURE ON THE ELASTICITY MODULUS AND DAMPING OF THE METALS: COPPER, SILVER, ALUMINIUM AND MAGNESIUM. Werner Koster. Translated by M. W. Buxton from Z. Metallkunde 39, 9-12(1948). 7p.

The variation of the elasticity modulus and damping with temperature was determined for Cu, Ag, Al and Mg. Over an extended range of temperature these four metals show an unexpected decrease of the elasticity modulus and increase of the damping. The height of the bulge in the curve depends on the purity of the metal. The effect is thus dependent on composition. The unusual effect on both properties is removed in the cases of Cu and Ag by deoxidizing treatment or by addition of deoxidizing elements. On the basis of known views on the nature of damping the phenomenon was attributed to diffusion of foreign atoms brought about by mechanical stresses. Oxygen plays a decisive role in the origin of the phenomenon. (auth)

344

DIFFUSION PARAMETERS IN X-RAY ABSORPTION SPECTRA OF ATOMS IN ALLOYS. I. Ya. Dekhtyar (Inst. of Metal-Physics). Doklady Akad. Nauk S.S.S.R. 108, 1069-71(1956) June 21. (In Russian)

Interatomic interactions in alloys of Fe, Ni, Co, and other transition metals conditioned by the structure of the electron shells of isolated atoms and the changes taking place during fusion are investigated. The relation between diffusion parameter and K spectra of Co absorption in fusion with Cr and other metals was analyzed and tabulated. (R.V.J.)

345

ALTERATIONS IN CARBIDE CRYSTAL SIZE IN TEMPERING HARDENED CHROMIUM STEEL. Z. K. Kos'ko (Dnepropetrovskiĭ Metallurgical Inst.). Doklady Akad. Nauk S.S.S.R. 108, 1072-5(1956) June 21. (In Russian)

Investigations were made to determine the size of carbide crystals in annealed steel with 0.7, 3.8, and 18% of chromium content at temperatures of 450 to 700°, and during their transitions from carbide of one type to another: $(Fe, Cr)_3C$ with rhombohedral lattice to trigonal carbide $(Cr, Fe)_7C_3$ with hetogonal lattice, and in steels with higher Cr content from $(Cr, Fe)_7C_3$ at low temperature to $(Cr, Fe)_{23}C_6$ with cube lattice at high temperature. (R.V.J.)

346

CONSTITUTIONAL DIAGRAM OF TITANIUM–IRON ALLOYS. I. I. Kornilov and N. G. Boriskina (Baĭkov Inst. of Metallurgy). Doklady Akad. Nauk S.S.S.R. 108, 1083-5(1056) June 21.

The constitutional diagram of Ti–Fe was developed by thermal, dilatometric, microstructural, and x-ray methods of analysis. The hardness and microhardness were also checked. The hydride dust of 99.2% Ti and 99.6% Fe reduced by hydrogen were used as the source of alloy material. Compressed and fused specimens were thermally treated at 1000°C for 100 hr, 800° for 24 hr, and at 500° up to 1000 hr, and observed in the interval and final cooling conditions. The boundary diffusion of Ti into iron was determined by annealing the alloys at various temperatures. The results showed the maximum diffusion of 12% Ti at 1200°; 8.5% Ti at 1100°; 7.5% Ti at 1000°; 5% Ti at 900°; 4% Ti at 800°, and 2.5% Ti at 500°. (R.V.J.)

347

MATERIALS OF CONSTRUCTION—ALUMINUM ALLOYS. R. L. Horst (Aluminum Company of America, New Kensington, Penna.). Ind. Eng. Chem. 48, 1696-1701(1956) Sept.

A review of the year's progress in Al alloy development for atomic energy applications is given. Resistance of the alloys to atmospheric exposure was studied. (F.S.)

348

MATERIALS OF CONSTRUCTION—LESS COMMON METALS. E. M. Sherwood (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 48, 1735-41(1956) Sept.

A review is given of recent information concerning the less common metals: Zr, Hf, Mo, Ta, Nb, Rh, and ductile Cr. This year's achievements have been largely in improving refining methods, protective coatings, processing techniques and alloy development. (F.S.)

349

MATERIALS OF CONSTRUCTION—NICKEL, INCLUDING HIGH-NICKEL ALLOYS. R. M. Fuller (International Nickel Co., Inc., New York). Ind. Eng. Chem. 48, 1742-59(1956) Sept.

A review of the recent literature on Ni and Ni alloys, includes research on plating, high-temperature properties and applications, mining, production, availability, physical metallurgy welding, and fabrication. (F.S.)

350

MATERIALS OF CONSTRUCTION—STAINLESS STEELS INCLUDING OTHER FERROUS ALLOYS. Walter A. Luce (Curiron Co., Inc., Dayton, Ohio). Ind. Eng. Chem. 48, 1775-87(1956) Sept.

Development in stainless steels and other ferrous alloys on problems of corrosion, mechanical properties, structure, high-temperature properties and uses, welding, working, and surface treatments are reviewed. (F.S.)

351

MATERIALS OF CONSTRUCTION—TITANIUM. H. B. Bomberger (Rem-Cru Titanium Inc., Midland, Penna.). Ind. Eng. Chem. 48, 1794-7(1956) Sept.

A survey of current literature on the production, fabrication, oxidation, corrosion, and physical metallurgy of titanium is given. 53 references are included. (F.S.)

352

MODIFY 12 PCT Cr STEELS FOR BETTER PROPERTIES. Paul Shahinian and J. R. Lane (Naval Research Lab., Washington, D. C.). Iron Age 178, No. 17, 108-12(1956) Oct. 25.

A study is presented of the effects of various modifications in chemistry aimed at developing a new 12% Cr steel that is metallurgically superior. (J.E.D.)

353

ON THE SOLUBILITY OF OXYGEN IN LIQUID NICKEL AND IN IRON–NICKEL ALLOYS. A. M. Samarin and V. P. Fedotov. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 6, 119-25(1956) June. (In Russian)

Data obtained for solubility of oxygen in pure nickel coincided with the data previously reported. However, the data for oxygen solubility in Fe–Ni alloys showed much higher solubility factor, especially, for the alloys with high content of Ni. (R.V.J.)

354

HEAT RESISTANCE PHASE DIAGRAM OF Ni–Cr–Ti ALLOYS. I. I. Kornilov and L. I. Pryakhina (Moscow Inst. of Metallurgy). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 7, 103-10(1956) July. (In Russian)

Microstructures, heat resistance, and physico-chemical properties of Ni–Cr–Ti alloys were studied on two cross sections containing constant 10% and 20% Cr respectively, and a variable amount of Ti from 0 to 15%. The relations between the alloy phase structure and their properties and the Ti effects on their hard solutions were investigated. Results showed a gradual solubility of Ti in γ-hard Ni solution at 800°C. The binary alloy Ni–Ti contained 10% of Ti, the 10% Cr triple alloy Ni–Cr–Ti was 5.5 to 6% Ti, and the triple alloy with 20% Cr, 3.0 to 3.5% Ti. The maximum heat resistance of 10% Cr triple alloy was found to be with 5.7 to 6% Ti, and in 20% Cr alloy with 3.4 to 4.4% Ti. Diagrams of heat resistance tested in 800°C during a 1000-hr period are given. (R.V.J.)

355

ON THE RECRYSTALLIZATION OF TITANIUM AND ITS ALLOYS (DIAGRAMS OF TITANIUM RECRYSTALLIZATION). E. M. Savitskiĭ, M. A. Tylkina, and A. N. Turanskaya. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 7, 111-14(1956) July. (In Russian)

Microstructures resulting from different compression and heat treatments were studied on specimens of commercially prepared pure Ti. Diagrams of recrystallization of cold-rolled and annealed specimens and of compressed specimens treated by annealing and of hot deformation by forging are presented. (R.V.J.)

356

INVESTIGATION OF INTERSOLUBILITY OF TITANIUM AND LEAD AT TEMPERATURE LEVEL OF 600, 700, AND 800°C. B. N. Rabinovich and D. M. Chizhikov. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 7, 114-17(1956) July. (In Russian)

The intersolubility of melted Pb and powdered Ti in vacuum or argon atmosphere begins at 500°C, and a homogeneous gray cake of Ti_4Pb is formed. The chemical reaction proceeds quite intensively due to the large well developed surface of powdered Ti. (R.V.J.)

357

INVESTIGATIONS OF RECRYSTALLIZATION OF TITANIUM AND TITANIUM ALLOYS. DIAGRAMS OF RECRYSTALLIZATION OF TITANIUM ALLOYS. Yu. A. Zot'ev, E. V. Savitskiĭ, M. A. Tylkina, and A. N. Turanskaya. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 8, 135-8(1956) Aug. (In Russian)

358

THE REACTIONS OF MOLTEN SODIUM HYDROXIDE WITH VARIOUS METALS. D. D. Williams, J. A. Grand, and R. R. Miller (Naval Research Lab., Washington, D. C.). J. Am. Chem. Soc. 78, 5150-5(1956) Oct. 20.

Under the conditions of the system geometry and at temperatures up to 1000°, the primary reaction of sodium hydroxide with the investigated metals appears to follow a pattern illustrated by the general equation (A) NaOH + Metal → Na_2O + Metal Oxide (or Sodium Metalite) + H_2. The various metals differ only in rate of reaction and valence state of the combined metal, each tending to form its most stable or common oxide. The secondary reactions digress, with only those metals having easily reduced or unstable oxides reaching a steady-state condition. Hence, chromium, iron, titanium, beryllium, tantalum, manganese and ferrous alloys exhibit only reaction (A). Nickel, copper, Monel, gold and probably silver and cobalt exhibit one or more of the following secondary reactions leading to a "steady-state" condition. (B) Metal Oxide + H_2 → Metal + H_2O; (C) $Na_2O + \frac{1}{2}H_2$ → NaOH + Na; (D) H_2O + Na → NaOH + $\frac{1}{2}H_2$. In the presence of nickel, copper, Monel and probably cobalt, reactions (B) and (C) are reversible. In the presence of gold and probably silver, reaction (C) is not reversible by reason of the formation of an alloy between the noble metal and the produced sodium metal. For the same reason and because of the stability of the alloy formed, reaction (D) is prevented. Therefore, only nickel, copper, and their alloys and probably cobalt will produce definite equilibria, since the summation of equations B, C and D is the exact reverse of the primary equation A. Only these metals are protected by hydrogen additions prior to heating. If reaction A proceeds to completion, with the hydrogen constantly removed by evacuation, and, if there is an excess of reacting metal present, all of the metals investigated will react further with the sodium oxide fraction of the primary reaction product (E) Na_2O + Metal → Metal Oxide + 2Na. Reaction E proceeds completely to the right only if provision is made to remove the metallic sodium from the reaction zone, either by distillation or alloy formation. (auth)

359

CORRECTION FACTOR FOR THE QUANTITATIVE DETERMINATION OF FIBER TEXTURES. W. P. Chernock, Joseph Singer, Melvin H. Mueller, and Paul A. Beck (Univ. of Illinois, Urbana). J. Appl. Phys. 27, 1170-2 (1956) Oct.

Experimental texture data were collected for a titanium and a uranium rod in order to test the applicability of the $\sin\phi$ correction factor to be used with pole charts for fiber textures. Comparison of the corrected and uncorrected integrated intensity values for pole charts corresponding to various reflections with the calculated intensity values indicates that the agreement is greatly improved when the $\sin\phi$ correction factor is used. (auth)

360

DIFFUSION OF GOLD IN SINGLE CRYSTALS OF SILVER. F. E. Jaumot, Jr. and A. Sawatzky (Franklin Inst. Labs. for Research and Development, Philadelphia). J. Appl. Phys. 27, 1186-8(1956) Oct.

The diffusion of Au in Ag has been measured in the temperature range from 650 to 950°C, using Au^{198} as a tracer. The data indicate that the diffusion coefficient is given by the equation $D = 0.26 \exp(-45{,}500/RT)$ cm^2/sec. The fact that the activation energy for the diffusion of Au

in Ag is identical to that for self-diffusion in Ag is discussed briefly. (auth)

361

RADIATION DAMAGE TO METALS AND ASSOCIATED PROBLEMS. THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF METALS. M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 84, 101-3(1956) Aug.

362

METALLOGRAPHIC METHODS FOR HIGHLY ACTIVE SPECIMENS. P. C. L. Pfeil. J. Inst. Metals 84, 108-11 (1956) Aug.

Methods are outlined for metallographic examination of specimens having a high γ activity. The methods were intended for activities up to 1 kilocurie, but results are available only on specimens of activities below 1 curie, prepared and examined in a small-scale apparatus. (J.E.D.)

363

DECOMPOSITION OF THE BETA PHASE IN A COPPER–GALLIUM EUTECTOID ALLOY. Chester W. Spencer (Cornell Univ., Ithaca, N. Y.) and David J. Mack (Univ. of Wisconsin, Madison). J. Inst. Metals 84, 461-6(1956) Aug.

The eutectoid decomposition of the β phase in the copper–gallium system was studied by the isothermal-transformation technique. Decomposition of the β phase takes place in two steps: (i) the formation of the low-temperature ζ phase, supersaturated to the eutectoid composition, from the high-temperature β phase; (ii) the precipitation of the other low-temperature phase, the γ phase, from the supersaturated ζ matrix to form the equilibrium two-phase mixture. There is no evidence that the transformation proceeds by the nucleation and growth of pearlite nodules during either continuous cooling from the β phase region or during isothermal transformation below the eutectoid temperature. A time/temperature/transformation diagram for the eutectoid alloy is proposed. (auth)

364

ELECTRON-MICROSCOPIC OBSERVATIONS ON THE PRECIPITATION OF THE THETA PHASE IN AN ALUMINIUM-4% COPPER ALLOY. E. Langer (Technical Univ., Copenhagen, Denmark). J. Inst. Metals 84, 471-2(1956) Aug.

In an electron-microscopic study of the precipitation of the θ'-phase in an Al–4% Cu alloy, it has been observed that precipitation occurs in slip planes and polygon boundaries, but not in grain boundaries. Here structureless bands of a thickness of approximately 1500 A. are found. A possible explanation of the observations is given. (auth)

365

PAST, PRESENT, AND FUTURE OF HIGH TEMPERATURE NICKEL BASE ALLOYS. F. L. VerSnyder (General Electric Co., Schenectady, N. Y.). J. Metals 8, 1145-9(1956) Oct.

Nickel base super alloys appear to have an extremely bright future if they can be made into reliable engineering materials capable of being produced in production quantities. The trend towards higher Ti and Al is consistent with our knowledge that increasing amounts of solute elements improves creep resistance of a solvent, and that precipitation of a second phase, if it is adjusted properly, can increase the resistance to rupture. In applications where static and dynamic stresses are comparatively high, increased study of both present complicated alloys and utilization of fundamental work on simple systems should lead to a better understanding. When this has been accomplished, higher useful service temperatures will be attained. (auth)

366

EFFECT OF MELTING AND CASTING ATMOSPHERES ON CAST NICKEL ALLOYS. C. M. Hammond and R. A. Flinn (Univ. of Michigan, Ann Arbor). J. Metals 8, 1450-6(1956) Oct.

A summary of experimental results is presented. In all three alloy types, melting under vacuum and casting under argon atmospheres improves ductility two to tenfold under stress-rupture test conditions at 1500°F. Stress-rupture strength at 1500°F is improved in the Guy-type alloy by 38% and in the Inco-700 type by 13% with the argon and vacuum melting technique compared with air melting. No change occurs in the GMR-235 type. The air-melted and argon-protected heats contain from five to ten times the nitrogen of the vacuum and argon heats. (auth)

367

PARTICLE SIZE DETERMINATION IN POWDER METALLURGY. A GENERAL REVIEW OF AVAILABLE METHODS. L. A. Phelps. Metallurgia 54, 197-200(1956) Oct.

The basic principles underlying the more important methods for estimating particle size are presented. The properties of the powder are greatly influenced by the size range of the raw material and its distribution within that range. The measurement of particle sizes are found to be of importance in the manufacture of carbides and metal-bonded ceramics for high-temperature service. (J.E.D.)

368

RESIDUAL RESISTIVITY VS. SHORT-RANGE ORDER IN Cu_3Au. A. C. Damask (Frankford Arsenal, Philadelphia). Phys. and Chem. of Solids 1, 23-6(1956) Sept.-Oct.

The electrical resistivity of Cu_3Au has been measured at 77°K after quenches from various temperatures above T_c, the critical temperature for long-range order. The resistivity decreases with increasing quench temperature up to 485°C, and measurements at 4°K show essentially the same behavior. The origin of this resistance decrease is assigned to short-range order. This decrease of residual resistivity in Cu_3Au with decreasing short-range order is opposite to the results of previous measurements on α brass. Some implications of these two types of resistivity behavior are discussed. (auth)

369

THE EFFECT OF SHORT-RANGE ORDER ON RESIDUAL RESISTIVITY. John B. Gibson (Brookhaven National Lab., Upton, N. Y.). Phys. and Chem. of Solids 1, 27-34(1956) Sept.-Oct.

A general theory, based on the Nordheim approximation, is given for the residual resistivity of binary solid solutions with short-range order but no long-range order. For Cu_3Au this theory predicts about an 18 per cent increase in resistivity with short-range order just above the ordering temperature, in agreement with experiment. For a brass, the agreement is poorer, an 0.4 per cent increase in resistivity being predicted in comparison with a 12 per cent decrease observed. Qualitative considerations are given for estimating the effect of short-range order for an arbitrary solid solution. In general, the short-range order may be expected to decrease the resistivity of a binary solid solution whose constituents have different valence when the Fermi surface passes close to a Brillouin zone boundary for the random lattice. An increase should occur when the Fermi surface is close to a zone boundary for the superlattice. (auth)

370

DIRECT OBSERVATIONS OF THE ARRANGEMENT AND MOTION OF DISLOCATIONS IN ALUMINIUM. P. B. Hirsch, R. W. Horne, and M. J. Whelan (Cavendish Lab.,

Cambridge, England). Phil. Mag. (8) 1, 677-84(1956) July.

Electron optical experiments on Al foils have revealed individual dislocations in the interior of the metal. The arrangement and movement of individual dislocations have been observed. Most of the dislocations occur in the boundaries of a substructure, the diameter of the subrains being of the order of 1 μ or more. Tilt-boundaries, networks and dislocation nodes have been resolved. The results apply to aluminum recovered at 350°C after heavy deformation by beating; the dislocation density is $10^{10}/cm^2$. The dislocations can be seen to move along traces of (111) slip planes; the motion of the dislocations can be either rapid or slow and jerky. Cross-slip by the screw dislocation mechanism has been observed frequently. (auth)

371

A STUDY OF THE IODIDE PROCESS OF REFINING ZIRCONIUM. THE LOWER ZIRCONIUM IODIDES AND THE EFFECT OF TETRAIODIDE PRESSURE ON THE RATE OF METAL DEPOSITION. V. S. Emelyanov, P. D. Bystrov, and A. I. Evstyukhin. Soviet J. Atomic Energy, No. 3, 415-24 (1956).

The lower iodides which are formed on the surface of the raw metal do not directly influence the rate of zirconium deposition. Their effect is indirect: the formation of a lower iodide during a protracted refining process results in the complete disappearance of the solid tetraiodide and to changes of its vapor pressure inside the reaction vessel, and this, in turn, leads to a change of the rate of metal deposition. The principal causes of a diminished rate of zirconium deposition at tetraiodide pressures above 0.2 to 0.3 mm are the slowing down of diffusion (smaller diffusion coefficients with increased pressure) and the formation of the lower iodides on the surface of the heated zirconium rod. The role of the latter factor is considerably strengthened at very high tetraiodide pressures, when the reverse process, that of dissolution of the rod, can also begin. (auth)

372

TUBES OF HEAT-RESISTING ALLOYS. V. S. Mikheev. Vestnik Akad. Nauk S.S.S.R. 26, 40-2(1956) July. (In Russian)

The technological properties and use of triple ferrite alloy 24 to 26% Cr, 4.5 to 6% Al, 0.5 Ti and Fe with small admixtures of C, S, P, Si, Mn, and Ni developed for use in high-temperature pyrolysis of gaseous and liquid hydrocarbons are reported. The chemical interaction fused Fe, Cr, Al, and Ti into a compact ingot with strong heat resistance and oxidation losses of 0.06 g/m^2 per hr at 1200°. The alloy does not show carbonization tendencies during carbon pyrolysis, permitting the prolonged chemical treatment of materials. New alloys of iron with 60 to 65% Cr and 6 to 8% Al, with heat resistance to temperatures up to 1350 to 1400°C were also recently developed and are now tested as material for reactors, etc. (R.V.J.)

373

FUSION WELDING ZIRCONIUM FOR A NUCLEAR REACTOR. Bruce L. Baird (North American Aviation, Inc., Downey, Calif.) Welding J. (N. Y.) 35, 1007-14(1956) Oct.

The tooling and techniques developed to permit the welding of large Zr assemblies on a production basis are reported. (J.E.D.)

374

PROBLEMS INVOLVED IN SPOT WELDING TITANIUM TO OTHER METALS. Frank W. McBee, Jr., Jimmy Henson, and L. R. Benson (Univ. of Texas, Austin). Welding J. (N. Y.) 35, 481s-7s(1956) Oct.

The properties and problems of spot welding commercially-pure Ti to stainless steel, Al, Mg Zr, Ni, Cr, and Fe are examined. General information concerning the nature of the welds is discussed. (J.E.D.)

375

FABRICATION AND WELDING OF ARC-CAST MOLYBDENUM. R. E. Monroe, N. E. Weare, and D. C. Martin (Battelle Memorial Inst., Columbus, Ohio). Welding J. (N. Y.) 35, 488s-98s(1956) Oct.

The objective of this investigation was the development of improved methods and procedures for producing molybdenum weldments with good room-temperature ductility. Sheet materials and fusion weldments made in a dry box from $\frac{1}{16}$- and $\frac{1}{8}$- in.-thick arc-cast molybdenum had good bend properties at low temperatures. The best ductility was obtained from 0.7% titanium alloys and carbon-deoxidized molybdenum with a low-carbon content (>0.025%). The effects of variation in composition and fabrication procedures on the ductility of fusion weldments were studies for titanium-neutralized and carbon-deoxidized molybdenum. The titanium-neutralized alloy containing 0.7% titanium had better weldment ductility than alloys containing 0.5 and 1.0% titanium. Simplified melting and fabricating procedures did not adversely affect the ductility of titanium-neutralized molybdenum weldments, although double melting of the ingots was required to avoid weld porosity. Better weld ductility was obtained from lower carbon content material in commercial carbon-deoxidized arc-cast molybdenum. However, the ductility of sheet and weldments in experimentally rolled carbon-deoxidized molybdenum was not affected by the carbon content. Rolling sheet in a protective jacket did not affect the ductility in either type of molybdenum. An over-all improvement in weldment ductility was obtained by welding in a high-purity helium atmosphere and grinding the weld surface after welding. (auth)

376

A WELD CRACKING SUSCEPTIBILITY TEST FOR SHEET MATERIALS. E. H. Kinelski and G. R. Pease (International Nickel Co., Bayonne, N. J.). Welding J. (N. Y.) 35, 498s-500s(1956) Oct.

377

WETTABILITY OF STEEL WITH PURE SILVER AND VARIOUS SILVER-BRAZING ALLOYS. Nikolajs Bredzs (Armour Research Foundation, Chicago). Welding J. (N. Y.) 35, 508s-20s(1956) Oct.

In the course of the investigation of wettability of low-carbon steel by pure silver and some silver-base brazing alloys under a layer of molten flux, a new phenomenon was observed. It was named "rotation phenomenon." The "rotation phenomenon" demonstrated the influence of oxygen diffusion through layers of molten silver and various silver-base brazing alloys on the wettability of the steel surfaces. A fundamental study of oxygen diffusion through layers of molten silver with and without deoxidizing additions has been carried out. The mechanism of the formation of iron-oxide layers and nucleation of CO bubbles on the steel-filler metal interface has been investigated. The experiments performed on silver alloys containing strong deoxidizers open vistas of future research on self-fluxing brazing alloys. They indicate new possibilities for the development of self-fluxing, airproof brazing alloys. (auth)

378

EFFECT OF AN ADSORBED FILM OF DIPOLE MOLECULES ON THE ELECTRONIC WORK FUNCTION. N. D. Morgulis and V. M. Gavriliuk (Academy of Sciences, Ukrainian SSSR). Soviet Phys. JETP 3, 159-67(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 149-59 (1956) Jan. (In Russian)

An experimental investigation was performed, under high-vacuum conditions, of the variation of the work function of W when an accurately measured film (of varying thickness) of cesium chloride molecules was deposited on

it; these molecules contained an admixture of radioactive isotope Cs^{134} and, as a result, the density of the molecules in the film could be determined fairly accurately by the magnitude of its activity. It was shown that a film of CsCl molecules, having their own dipole moment, causes a decrease in the value of the work function of the tungsten; however, this decrease is considerably less than that produced by a film of cesium atoms. A comparison was made between these systems and data extracted from the literature for BaO–W and Ba–W systems. A discussion of several ways in which the results obtained here may be interpreted theoretically is given. (auth)

379

THE STRUCTURE OF SUPERCONDUCTORS. IX. ROENTGENOGRAPHIC DETERMINATION OF THE STRUCTURE OF α-Bi_4Rh. V. P. Glagoleva and G. S. Zhdanov (Moscow-Physico-engineering Inst.). Soviet Phys. JETP 3, 155-8 (1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 248-51(1956) Feb. (In Russian)

The structure was determined of the low-temperature modification of Bi_4Rh, which belongs to the space group O_h^{10}–Ia3d, with a lattice period a = 14.928 A. The positions of the bismuth and rhodium atoms were determined by a very precise method of constructing the cross sections and projecting the series of inter atomic vectors (F^2-series) and the series of electron densities (F-series). (auth)

380

THE EFFECT OF UNIFORM COMPRESSION ON THE SUPERCONDUCTING PROPERTIES OF THE α-β-MODIFICATIONS OF Bi_2Pd. N. E. Alekseevskii and I. I. Lifanov (Academy of Sciences, USSR). Soviet Phys. JETP 3, 294-5(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 405-6(1956) Feb. (In Russian)

A determination was made of the displacement of Tc, the transition temperature for superconductivity, under uniform compression for both forms of the compound Bi_2Pd. The experimental procedures are described in some detail, and results are shown in graphical form. (B.J.H.)

381

FUSION OF LITHIUM TITANATES WITH OTHER SALTS. I. N. Belyaev and N. P. Sigida (Rostov-on Don State Univ.). Zhur. Obshcheĭ Khim. 26, 1553-8(1956) June. (In Russian)

Investigations were made of lithium titanate fusion with fluorides, sulfates, silicates, pyrophosphates, and other salts of Li, Na, and K. Results showed that at temperatures up to 1100° lithium titanates do not diffuse into salts of Li_2SO_4, Li_2MoO_4, Li_2WO_4, $LiPO_3$, LiCl, and LiF, and in temperatures up to 1100° they do not melt in Li_2SiO_3, Li_3PO_4, Li_3VO_4 (the mixtures with up to 15% Li_2TiO). A certain similarity has been established between lithium titanates and barium titanates by comparing the diffusion of Li_2TiO_3 in the above salts and by establishing the temperatures of methanite melting points. The studies also established that Li_2TiO_3–2NaF, Li_2TiO_3–2KF, Li_2TiO_3–2RbF, and Li_2TiO_3–Na_2SiO_3 have stable diagonal cross sections of corresponding triple intersystems. (R.V.J.)

382

STRATIFIED STRUCTURES OF FUSED LITHIUM AND SILVER CHLORIDES AND WOLFRAMATES. D. S. Lesnykh and A. G. Bergman (Roston-on-Don State Univ.). Zhur. Obshcheĭ Khim. 26, 1560-4(1956) June. (In Russian)

Diagrams are given of the melt, crystallization, and cross sections of fused Li, Ag|| Cl, WO_4. Diagonal cross sections of wolframate and molybdate triple systems of the same cations are analyzed. (R.V.J.)

Refer to abstracts 392, 451, and 761.

PHYSICS

383 AERE-GP/R-1918

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A PRELIMINARY INVESTIGATION OF SHOCKS IN A CURVED CHANNEL. R. Hide and W. Millar. June 1956. 23p.

When a plane shock is introduced into a curved channel, centrifugal pressure forces arise which modify the gas flow behind the shock. In general, the shock front becomes curved, the curvature being non-uniformly distributed along the front. However, according to theory, when the shock moves at a certain uniform angular speed corresponding to a mach number M_c in a narrow channel the shock front should be straight. M_c depends only on the ratio of the principal specific heats of the gas; in the case of air M_c = 2.53. The processes arising when a plane shock enters a curved channel have been examined with the aid of the 8 in. × 2 in. shock tube. Under certain conditions, when the shock had progressed only a short distance downstream of the channel entry it developed a curved front which moved at a uniform angular speed around the channel. Shadowgraph observations have been compared with the predictions of Whipple's theory of the shape of such shocks, and fairly good agreement has been found. (auth)

384 NP-6125

Bartol Research Foundation, Philadelphia.

STUDIES IN MIXED CONDUCTION IN SOLIDS. W. E. Danforth. Aug. 31, 1956. 91p. Project TB2-0001-(718). Contract DA-36-034-ORD-1487RD.

Studies concerning the form of electrical conduction where both ions and electrons participate as carriers were made with ThO_2. The ion densities and mobilities as determined from the initial slope of the polarization curve, the use of probes to determine the distribution of polarization potential, instability, optical absorption spectra, theory of mixed spectra, and the theory of polarization with one kind of ionic carrier are reported. (F.S.)

385 OSR-TN-56-382

Stanford Research Inst., Menlo Park, Calif.

ECONOMIC AND DESIGN STUDY OF SOLAR FURNACES. Technical Report No. III. (Report No. 6). Robert E. De La Rue, Jr., Thomas E. Tietz, and Nevin K. Hiester. June 21, 1956. 58p. SRI Project No. CU-1410. Contract AF18(600)-1499. (AD-95818).

An economic and design study of solar furnaces has been conducted which relates specific furnace performance characteristics, such as maximum temperature, heat flux, and image size to the relative cost of construction. This study, which indicates the optimum economic design conditions to obtain specific performance characteristics, is covered in detail in this report. (auth)

386 UCRL-3421

National Bureau of Standards. NBS-AEC Cryogenic Engineering Lab., Boulder, Colo.

CRYOGENIC DATA BOOK. Dudley B. Chelton and Douglas B. Mann. May 15, 1956. 116p. [For] Univ. of Calif. Radiation Lab. Contract W-7405-eng-48. $18.30 (ph OTS); $6.00(mf OTS).

Data and reference information on the cryogenics of liquids, gases, and solids are given. Included are data on the properties of liquid H_2, D_2, N_2, O_2, O_2–N_2, He, gaseous H_2, N_2, D_2, and O_2 and solids such as Al alloys, Be–Cu alloy, Cu, phosphor bronze, stainless steels, plastics, and glass. The data were compiled with a view toward the design of liquid H_2 bubble chambers. (J.H.M.)

387 AEC-tr-2643

THERMODYNAMIC PROPERTIES OF SOLUTIONS OF MOLTEN SALTS B. F. Markov. Translated from Ukrain. Khim. Zhur. 21, 703-9(1955). 12p.

From a comparison of phase diagrams for binary salt systems with excess partial isobar potential of the first component, it follows that a particular type of diagram goes with a certain isobar potential (positive, zero and negative). The positive potential is observed only for systems which form solid solutions; the zero potential is observed in eutectic systems (ideal solutions, which answer to the Schroeder-LeChatelier equation); the negative potential is observed for systems with chemical interaction. The more distinctly the chemical compounds are shown in the diagrams, the more negative the excess isobar potential will be. According to the thermodynamic properties of the first component, binary solutions of molten salts may be roughly divided into four groups: the simplest (or ideal) solutions, regular solutions, solutions of associated components without chemical interaction, and solutions from associated components with chemical interaction. (auth)

388 AEC-tr-2651

ON THE STATISTICAL THEORY OF BRITTLE STRENGTH. (K Statisticheskoi Teorii Khrupkoi Prochnosti). Bureau of Ships Translation 603. B. B. Chechulin. Translated by Lloyd G. Robbins (F. A. Raven, ed.) from Zhur. Tekh. Fiz. 24, 292-8(1954). 15p.

A critical analysis is given of the main points in statistical theories proposed by Weibull and Kentorova and Frenkel. It is established that some inadequacies in these theories result from poor theoretical assumptions concerning a statistical distribution of dangerous defects, which are statistically distributed about the volume of the body and are responsible for the general disintegration of the body when under stress. By assuming a Type III Pearson distribution function as best substantiated for the given case, a new solution of the statistical theory by Kontorova and Frenkel is mathematically presented; moreover, the accuracy of this solution in comparison with the previous solution is demonstrated. It is demonstrated that the Weibull equation constitutes a special case of the proposed formula for brittle strength when the number of defects in the volume of the body is great. (auth)

389 AERE-Lib/Trans-741

CONTRIBUTIONS TO THE KNOWLEDGE OF THE MECHANICS OF BRITTLE MATERIALS. F. Kick. Translated by F. Hudswell from Dinglers Polytech. J. 247, 1-5 (1883). 5p.

The application of the principle that governs the change of shape of ductile bodies to the comminution of brittle substances, such as cast iron, glass, and stones, is discussed. (J.H.M.)

390

CONTROLLED THERMONUCLEAR REACTIONS PROGRESS TOWARD "FUSION" POWER. D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). Chem. Eng. Progr. 52, 134-6(1956) Sept.

Recent Russian revelations concerning thermonuclear reactions and "fusion" power are interpreted and discussed. (T.R.H.)

391

QUANTUM YIELD FROM PHOTOCHEMICAL CONVERSION ON F CENTERS IN HEATED POTASSIUM CHLORIDE CRYSTAL. A. A. Shtalov (Shevchenko Kiev State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 488-92(1956) Apr. (In Russian)

Results and methods of measuring the quantum yield from photochemical reversible conversion of F centers in KCl crystals in +280° temperature are described. A method is suggested for the calculations of simultaneously proceeding photochemical and thermal conversions processes, and an accurate calculation of quantum yield is given. The relation of the quantum yield of photochemical effect on F centers in KCl crystals to temperature was measured. (R.V.J.)

392

PHYSICAL PROPERTIES OF TITANIUM. II. THE HALL COEFFICIENT AND RESISTIVITY. Georgiana W. Scovil (Bryn Mawr Coll., Penna.). J. Appl. Phys. 27, 1196-8 (1956) Oct.

The Hall coefficient of titanium has been measured over a temperature range from 350 to 1100°K. The coefficient is -2.0×10^{-11} m^3/coulomb near room temperature, reverses sign at (6.75 ± 30) °K, and increases to a value of $+3.5 \times 10^{-11}$ m^3/coulomb at 1100°K. The measurements were made on titanium samples which had a purity of 99.99%. The samples were heated by direct current, and the temperatures were determined indirectly from the resistivity measurements which were made with each Hall measurement. The resistivity is 0.48 microhm m at 350°K. It increases to a maximum of 1.76 microhm m at the crystal transition temperature. (auth)

393

MEASUREMENT OF THE POLARIZABILITY OF METAL ATOMS WITH THE FIELD ELECTRON MICROSCOPE. H. Liepack and M. Drechsler. Naturwissenschaften 43, 52-3 (1956) Feb. (In Russian)

394

SOME PROBLEMS OF PARAMAGNETIC RESONANCE. S. A. Al'tsuler [Alt'shuler] (V. I. Lenin-Uljanov State Univ., Kazan, USSR) and B. M. Kozyrev (Kazan Section of the Academy of Sciences of the USSR). Nuovo cimento (10) 3, Suppl. No. 4, 614-28(1956).

The phenomenon of paramagnetic resonance is briefly surveyed. Acoustic paramagnetic resonance and paramagnetic resonance in iron group salt solutions are discussed in more detail. (B.J.H.)

AEROSOLS

395

AEROSOLS AND RADIOACTIVE GASES IN THE ATOMIC INDUSTRY. J. Labeyrie (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 929-37(1955) Oct. (In French)

Included are brief discussions of the radioactive aerosols in mines, the equipment used to measure the concentration, the aerosols and radioactive gases from reactors, aerosols and gas products of hot labs, and aerosols from atomic explosions. (B.J.H.)

COSMIC RADIATION

396 UCRL-Trans-240(I)

A MORE PRECISE DIFFUSION EQUATION OF COSMIC PROTONS IN AN INTERSTELLAR MEDIUM. Ya. P. Terletskii. Translated by S. Shewchuck from Doklady Akad. Nauk S.S.S.R. 101, 59-62(1955). 6p.

Acceleration of cosmic particles was considered as conditioned by turbulent motion of the magnetized interstellar medium. A distribution function of the particles with respect to range and energies was studied, and a diffusion equation was studied. (F.S.)

397

A NOTE ON THE ZENITH ANGLE DEPENDENCE OF

COSMIC RAY PROTONS AT SEA LEVEL. K. W. Ogilvie (Univ. of Sydney, Australia). Can. J. Phys. 34, 108-16 (1956) Oct.

In previous articles (Can. J. Phys. 33, 555, 746(1955)) the author has shown that the "heavy particle selector" may be used as a reliable detector both at sea level and at high altitudes. This note described its use to study the angular dependence of protons in the momentum range 700 to 1100 Mev/c. (auth)

398

HIGH ENERGY NUCLEAR PARTICLES FROM α-PARTICLE OF COSMIC RADIATION. Walter Winkler (Univ. of Bern, Switzerland). Helv. Phys. Acta 29, 267-80(1956) July. (In German)

399

SPLITTING OF HEAVY NUCLEI OF THE PRIMARY COMPONENTS OF COSMIC RADIATION AND REACTION WHICH THEREBY FORMS α-PARTICLES. F. Hänni (Univ. of Bern, Switzerland). Helv. Phys. Acta 29, 281-6(1956) July. (In German)

400

ON THE INTERACTION OF COSMIC RADIATION WITH MATERIALS AT 32 M.W.E. AND 200 M.W.E. UNDERGROUND. S. Higashi, I. Higashino, M. Oda, T. Oshio, H. Shibata, K. Watanabe, and Y. Watase (Osaka City Univ., Japan). J. Phys. Soc. Japan 11, 1021-9(1956) Oct.

Penetrating showers produced in lead and some other phenomena have been studied at 32 m.w.e. and 200 m.w.e. below the top of the atmosphere and at sea level with a counter hodoscope. As much cares as possible were taken to avoid uncertainties of the counter hodoscope study. The threshold energy of the penetrating showers observed was estimated as about 7 Bev taking into account the geometrical condition of the apparatus. The cross section for the penetrating showers at 32 m.w.e. was concluded as $(2.8 \pm 0.7)\ 10^{-31}$ cm^2/nucleon and about ten times bigger cross section was obtained at 200 m.w.e. Those events which were interpreted as the mixed shower coming from the earth above the apparatus were also studied. The energy involved in this phenomena has been estimated to be very high and the cross section was suggested. Occasionally two or more penetrating particles have traversed the apparatus in parallel with each other without being accompanied with soft components. The intimate association of air showers with these events was concluded. (auth)

401

UNUSUAL COSMIC RAY EVENTS OBSERVED IN A MULTIPLATE CLOUD CHAMBER. S. Naranan, P. V. Ramanamurty, A. B. Sahiar, Siddheshwar Lal, and A. Subramanian (Tata Inst. of Fundamental Research, Bombay, India). Nuovo cimento (10) 4, 651-6(1956) Sept.

Descriptions are given of two unusual events in which a particle comes to rest in one of the lead plates in the chamber and a charged secondary emerges from the plate with a range greater than 143 g/cm^2 of Pb in one case and greater than 185 g/cm^2 of Pb in the other. Various possible interpretations of the events are discussed, and it is concluded that interpretation of the events as chance coincidences or decays in flight of known K mesons or hyperons is improbable. The events could possibly be either antiproton annihilations or decays of K^+ mesons. (B.J.H.)

402

ANISOTROPY OF COSMIC RAYS DUE TO GALACTIC ROTATION. A. O. Barut (Univ. of Montreal, Canada). Nuovo cimento (10) 4, 661-5(1956) Sept.

Some of the experiments and calculations on the anisotropy of cosmic rays are reviewed. (B.J.H.)

403

THE ENERGY DISTRIBUTION OF COSMIC RAY PARTICLES OVER NORTHERN ITALY. P. H. Fowler and C. J. Waddington (H. H. Wills Physical Lab., Bristol, England). Phil. Mag. (8) 1, 637-50(1956) July.

The energies of 200 multiply-charged particles of the primary cosmic radiation have been determined from measurements of the multiple Coulomb scattering. These particles were found in a stack of emulsions exposed over northern Italy. The energy determinations have been shown to be reliable up to an energy of at least 3.0 Bev per nucleon. From these measurements the cut-off energy has been shown to be 1.55 ± 0.06 Bev per nucleon, instead of the 1.05 Bev per nucleon predicted by geomagnetic theory. The integral energy spectrum between 1.8 and 3.0 Bev per nucleon has been shown to be given by $N\ (>E) = 370\ (m_0c^2 + E)^{1.50}$, and between the above cut-off energy and 800 Bev per nucleon—from a consideration of α particle produced 'jets'—to have an exponent of 1.49. A value for the α-particle flux at the top of the atmosphere has been found of 93 ± 8 α particle/m^2/ster/sec. (auth)

404

THE SOLAR DAILY VARIATION OF THE COSMIC RAY INTENSITY. H. Elliot and P. Rothwell (Imperial Coll. of Science and Technology, London). Phil. Mag. (8) 1, 669-76 (1956) July.

Some recent measurements of the solar daily variation for cosmic rays incident from the east and west directions at 45° to the vertical in London are described. The results do not agree with those to be expected if the variation was due to a non-isotropic flux of primary particles entering the earth's magnetic field. This result is discussed in relation to other evidence, and it is concluded that the daily variation is probably due to a modulation of the primary cosmic ray intensity in the earth's magnetic field. (auth)

405

TIME VARIATION OF PRIMARY HEAVY NUCLEI IN COSMIC RADIATION. Masatoshi Koshiba and Marcel Schein (Univ. of Chicago). Phys. Rev. 103, 1820-4(1956) Sept. 15.

The time variation of heavy nuclei in the primary cosmic radiation was investigated by using the method of a moving-plate mechanism which was flown to an altitude of 100,000 feet by a Skyhook balloon. The results obtained clearly indicate a time variation of primary heavy nuclei $Z \gtrsim 10$. The variation is characterized by its maximum at around 9:00 a.m., having an amplitude of 34 ± 7% at the maximum. Comparisons are made with other experimental data on the same subject and also with the neutron intensity variation on the same day at Climax, Colorado. Possible consequences of this rather large fluctuation of the primary heavy nuclei are discussed. (auth)

406

COSMIC-RAY INCREASE AT HIGH ALTITUDE ON FEBRUARY 23, 1956. John R. Winckler (Univ. of Minnesota, Minneapolis). Phys. Rev. 104, 220(1956) Oct. 1.

A vertical telescope with a stopping power of 22 g/cm^2 was flown to an atmospheric depth of 10 g/cm^2 at Minneapolis. The particles apparently have energies less than one Bev, presumably originated near the sun and reached the earth by scattering from magnetic fields near the solar system. (auth)

407

SUGGESTION CONCERNING THE NATURE OF THE COSMIC-RAY CUTOFF AT SUNSPOT MINIMUM. F. Hoyle (Carnegie Institution of Washington, D. C. and California Inst. of Tech., Pasadena). Phys. Rev. 104, 269-70(1956) Oct. 1.

A suggestion is given for explaining the cosmic-ray cutoff in terms of an interstellar magnetic field. The role played by the diffuse gas, which probably exists in interplanetary space, in this phenomenon is discussed. (B.J.H.)

408

VARIATIONS IN INTENSITIES OF COSMIC RAYS. L. I. Dorman and E. L. Feĭnberg. Uspekhi Fiz. Nauk 59, 189-228 (1956) June. (In Russian)

Variations of cosmic-ray intensities caused by the atmospheric conditions and by acceleration, slowing down, and scattering in the corpuscular streams emitted by the sun, and by large and small sun eruptions are reviewed. Analyses of various phenomena and methods of study are discussed. (R.V.J.)

409

INVESTIGATION OF THE CLOSE-PAIR EFFECT IN COSMIC-RAY STARS BY MEANS OF MOVING PHOTOGRAPHIC PLATES. I. M. Gramenitskii, M. I. Podgoretskii, and Yu. F. Sharapova (P. N. Lebedev Physical Inst., USSR). Soviet Phys. JETP 3, 230-3(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 277-81(1956) Feb. (In Russian)

The problem of simultaneity in the creation of close-pair stars has been studied by means of moving photographic plates. It is shown that the so-called "associated" stars are produced at different moments of time. (auth)

410

ON THE THEORY OF STOCHASTIC PROCESSES IN COSMIC RADIATION. L. Pal. Soviet Phys. JETP 3, 233-7 (1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 362-6(1956) Feb.

A generalization of the kinetic equation of L. Janossy for the case where the physical quantity $\xi(t)$ does not remain constant between two consecutive jumps, but changes in accordance with some causal law is studied. The equation that is introduced can be successfully applied to various problems concerning stochastic processes in cosmic radiation. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

411 AECU-3364

Illinois. Univ., Urbana.

X-RAY SCATTERING BY SOLIDS CONTAINING VACANCIES AND INTERSTITIAL ATOMS. Arnold H. Kahn. [1955?]. 3p. Contract AT(11-1)-182. $1.80(ph OTS); $1.80(mf OTS).

The generalization of Huang's theory is given for the case of fcc-lattice containing vacancies at atom sites and interstitial atoms located at the body and edge-centered positions of solid materials. (R.V.J.)

412 K-1280

Oak Ridge Gaseous Diffusion Plant, Tenn.

THE CRYSTAL STRUCTURE OF ZIRCONIUM TETRAFLUORIDE. R. D. Burbank and F. N. Bensey, Jr. Oct. 31, 1956. 19p. Contract W-7405-eng-26. $0.20(OTS).

The crystal structure of ZrF_4 has been determined by x-ray-diffraction methods. Each Zr atom is coordinated by eight F atoms in the form of a square Archimedean antiprism, while each F atom is coordinated by two Zr atoms. Thus the structure consists of a three dimensional array of antiprism polyhedra which are joined together by sharing corners. (auth)

413 NP-6124

Eagle-Picher Research Labs., Joplin, Mo.

FUNDAMENTAL STUDIES OF THE LEAD–OXYGEN SYSTEM. Annual Summary Report No. 2 [for] August 1, 1955 to July 31, 1956. P. E. Jensen and E. J. Ritchie. Sept. 28, 1956. 64p. Project NR-052-349. Contract Nonr-1513(00).

An effort has been made to explain why an increase in temperature from 25°C to 475°C will cause some of the x-ray-diffraction lines of high purity yellow litharge to shift anomalously. The possible causes of anomalous line shifts, due to thermal expansion alone, that have been studied are (1) Polymorphic changes, (2) formation of an absorption or chemical compound with the gas in which it was heated, (3) the coexistence of two forms of yellow PbO at room temperature having different structures and properties, and (4) the assignment of the wrong crystal class, symmetry, and unit cell size to yellow PbO. The report treats in detail equivalent unit cells of several crystal classes which can be derived from the usually accepted orthorhombic unit cell. One of these unit cells, an orthohexagonal cell, gives better agreement for the line shifts as caused by thermal expansion but not all the line shift data can be included. The close relationship between the crystal structure of yellow PbO and the Beta form of solid oxygen is discussed and lends weight to considering yellow PbO to be of rhombohedral structure. The possibility of two forms of yellow PbO coexisting is very interesting since it offers a rational explanation for the wide variations observed in the use properties of yellow PbO made by different processes. (auth)

414 AERE-Lib/Trans-771

THE POSITIONAL CORRELATION OF THE OUTER ELECTRONS IN THE STRUCTURAL TYPES CuAu($L1_0$), PdCu($L2_0$) AND Cu_3Au($L1_2$). K. Schubert. Translated by F. Hudswell from Z. Metallkunde 46, 43-51(1955). 23p.

Structural theories, based on the positional correlation model, are discussed for the $L1_0$, $L1_2$, $L2_0$ and other structures. Some results of measurement of lattice constants on $L1_0$ phases some of which were obtained at higher temperatures are reported. (F.S.)

415

SUB-STRUCTURE FORMATION IN SLIGHTLY BENT ALUMINIUM SINGLE CRYSTALS. H. J. Lambot (Centre National de Recherches Metallurgiques (Section de Liege), Belgium). J. Inst. Metals 84, 473-4(1956) Aug.

The high-resolution x-ray method proposed by the author has been used in the study of single crystals of high-purity aluminum (99.99%) having the cube orientation. After bending at room temperature about a <010> direction, the (002) Bragg spot was recorded for various orientations of the <010> axis with respect to the direct beam trace (a vertical line). At an angle of 45°, a clearly resolvable substructure was observed (accompanied by a faint background). The recovery process observed appears to consist of three stages: (1) below 500°C., the polygonization mechanism described by Cahn transforms locally curved regions into new, perfect subgrains; (2) above 500°C., growth of some individual sub-grains is the main phenomenon; (3) within 10 to 30° C. of the melting point, a decrease in the perfection of the remaining sub-grains is detected, which may be correlated with Crussard's "recrystallization in situ". (auth)

416

REINFORCEMENT OF THE LUMINESCENCE FROM α SCINTILLATIONS BY ELECTRIC FIELDS. Joseph Mattler. J. phys. radium 17, 758(1956) Aug.-Sept. (In French)

417

THE POSSIBILITY OF A TWO-STEP EXCITATION MECHANISM IN SULFIDE PHOSPHORS. N. A. Tolstoi. Soviet Phys. JETP 3, 190-6(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 171-9(1956) Jan. (In Russian)

Experimental data on the kinetics of luminescence in

strongly quenched phosphors indicate that in spite of widely held ideas to the contrary, the bimolecular theory is not applicable. An interpretation of the experiments in terms of a two-step phosphorescence excitation mechanism is presented. It is shown that a two-step excitation process is responsible for photoconductivity in CdS (Cu) having high copper concentrations. Moreover luminescence in this material exhibits properties typical of strong quenching. (auth)

418

DEPENDENCE OF THE DIELECTRIC STRENGTH OF SOME ALKALI HALIDE MONOCRYSTALS ON THE APPLIED VOLTAGE. G. A. Vorob'ev (Polytechnic Inst. of Tomsk). Soviet Phys. JETP 3, 225-9(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 256-61(1956) Feb. (In Russian)

Dependence of the dielectric strength of monocrystals of NaCl, KCl, KBr and KI on the duration of the applied voltage was studied experimentally. The effects of the formation and rate of growth of the discharge in the dielectric are studied. The assumption is made that the increase in the breakdown potential when the duration of the applied voltage is of the order of 10^{-5} sec relative to the breakdown potentials for voltages of shorter duration is caused by the ionic volume charge. When pulses are used, a proportionality is observed between the dielectric strength and the energy of the crystal lattice. Experimental data and oscillograms point to the existence of two stages in the breakdown process of the investigated dielectrics. (auth)

ELECTRICAL DISCHARGE

419 AEC-tr-2580

SPECIAL CONDITIONS FOR ARCING OF AN ALTERNATING CURRENT (abstract). M. E. Britske. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 263(1954). 2p.

420 AEC-tr-2581

THE INFLUENCE OF THE ATMOSPHERIC PRESSURE ON THE INTENSITY OF SPECTRAL LINES IN A SPARK DISCHARGE (abstract). L. E. Vvedenskiĭ (Vvedensky). Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 275(1954). 2p.

421 AEC-tr-2644

THE INFLUENCE OF A STATIC MAGNETIC FIELD ON A HIGH-FREQUENCY GAS DISCHARGE WITHOUT ELECTRODES IN HYDROGEN. Bernhard Koch and Hugo Neuert. Translated from Z. Naturforsch. 4a, 456-63(1949). 21p.

The influence of a static magnetic field on a high-frequency gas discharge in hydrogen with pressures of about 1 to 50×10^{-3} mm Hg is investigated. The relation of the power absorption to the strength of the magnetic field shows a resonance-like course. The effect is most noticeable at low pressures. The location of the resonance points is dependent on the generator frequency, the gas pressures and the vessel dimensions. In the resonance region the generator (with about 20 MHz) is subjected to a strong change in frequency (up to 2 MHz). The observations lead to the conclusion of an occurrence of plasma oscillations in resonance with the generator frequency. The occurrence of the resonance in this instance is probably obtained by changes in the electron concentration. Determinations of the distribution of the magnetic alternating field in the discharge by means of a small wire loop as the detector also indicate the presence of fixed waves. At the point of resonance the field strength of the magnetic alternating field in general has a distinct minimum. In contrast to the above, very sharply defined high field strengths occur in the resonance with higher anode voltages of the generator in the case of a spherical discharge vessel. (auth)

422 AERE-Lib/Trans-732

INVESTIGATION OF LIGHT PHENOMENA RELATED TO THE DEVELOPMENT OF THE SPARK-DISCHARGE CHANNEL. M. P. Vanyukov, V. I. Isaenko, and L. D. Khazov. Translated by V. Beak from Zhur. Tekh. Fiz. 25, 1248-56(1955). 12p.

With the aid of an image converter, an investigation was made of the space time development of the light emission of the spark-discharge channel in the visible and infra-red regions of the spectrum, and also of the propagation of the shock wave formed during discharge. It was established that round the current-carrying channel there exists a layer of gas which emits on infra-red radiation consisting predominantly of the arc lines of the gas. Measurements were made of the mean along the channel, of the spectral density of the radiant energy of the discharge channel in A and Xe in the range 4000 to 10,000 A for different moments of time. Planck's formula was used to determine the mean temperature along the channel, which for the discharge in Xe reached a value of the order of 57,000°K. (auth)

423 AERE-Lib/Trans-733

EXPERIMENTAL PROOF OF ION SHEATHS SURROUNDING RECTIFIER ELECTRODES DURING DE-IONIZATION. W. Koch. Translated by W. G. Olscher from Z. tech. Phys. 17, 446-52(1936). 10p.

It was considered what influence the properties of ion sheaths, surrounding electrodes, have on the process of de-ionization in diodes and triodes. These influences were verified experimentally with a diode by measurements of the duration of the anode back-current at various vapor pressures. This at the same time, allowed a calculation of the ion concentration to be made with a triode, through measurement of the anode and grid after-currents, during whose flow the coalescing of the ion sheaths in the grid spaces was specially verified, and further through examination of the influence of grid potential, load current and vapor pressure. Apart from this, re-striking during de-ionization was examined. (auth)

424

ON THE MOBILITY AND SPACE CHARGE OF IONS IN A NON-UNIFORM FIELD. Yu. M. Kagan and V. I. Perel (Karelian-Finnish State Univ.). Doklady Akad. Nauk S.S.S.R. 108, 222-5(1956) May 11. (In Russian)

After a gas discharge, layers of positive charged ions may appear on the walls and electrodes. As a rule, the fields in these layers are not uniform. The mobility of positive ions in their own gas in such non-uniform fields have been investigated, considering the ion flow in sound under various pressures and the theory of cathode drop. (R.V.J.)

425

TRANSIENT ELECTRIC CURRENTS FROM PLASTIC INSULATORS. R. J. Munick (Argonne National Lab., Lemont, Ill.). J. Appl. Phys. 27, 1114-18(1956) Oct.

Change of voltage across a solid insulator produces a transient electric current. Measurements of currents from the polymers of methyl methacrylate, monochlorotrifluoroethylene, ethylene, styrene, and tetrafluoroethylene were made for times from 10 to 10^4 seconds after change in voltage at 25, 47°C, and several points below room temperature. The current produced by applying a constant voltage to an undisturbed specimen decays as the negative nth power of the time, where n is a constant between 0.7 and 1.1. The currents from polyethylene and polytetrafluoroethylene do not conform to the superposition principle, in contradistinction to what is usually reported for solid insulators. The currents at 100 seconds exhibit maxima at –32°C for polymethyl methacrylate and at –50°C for polymonochlorotrifluoroethylene. It is suggested that permanent electric dipoles

play an important role in the currents from polymethyl methacrylate and polymonochlorotrifluoroethylene. (auth)

426

RADIATION TEMPERATURE OF A PLASMA. Francis Bitter (Massachusetts Inst. of Tech., Cambridge) and John F. Waymouth (Sylvania Electric Products Inc., Salem, Mass.). J. Opt. Soc. Amer. 46, 882-4(1956) Oct.

The radiation temperature of a plasma is defined for some one emission line as the temperature at which the ratio of the number of atoms in the upper or radiating state to that in the lower or final state is in equilibrium. This temperature is always less than the electron temperature but approaches it at high current densities. Two results first derived by de Groot are discussed in some detail. The first is that the maximum possible spectral intensity of the resonance radiation emitted by a plasma is the blackbody intensity at the electron temperature. The second is that the radiated line width is an approximately derivable function of the ratio of the penetration depth of the center of the line to the lamp diameter. A procedure is given for estimating the electron temperature at high current densities. (auth)

427

ON THE INTERACTION OF ELECTROMAGNETIC WAVES WITH CHARGED PARTICLES AND THE OSCILLATIONS OF THE ELECTRONIC PLASMA. A. Ahiezer (Academy of Sciences of the USSR, Moscow). Nuovo cimento (10) 3, Suppl. No. 4, 591-613(1956).

A short survey is given of the results of several works on the theory of the interaction of charged particles with electromagnetic waves in dielectrics, magnetics, composite waveguides and electronic plasma, as well as on the theory of oscillations of free electronic plasma and of plasma in external fields. The general question of the polarization energy loss and the Cherenkov radiation in homogeneous dielectrics and magnetics is considered. (auth)

428

STRUCTURE OF MAGNETOHYDRODYNAMIC SHOCK WAVE IN A PLASMA OF INFINITE CONDUCTIVITY. W. Marshall (Atomic Energy Research Establishment, Harwell, Berks, England). Phys. Rev. 103, 1900(1956) Sept. 15.

Certain effects, which occur in a highly ionized plasma and which have previously been overlooked, are briefly discussed. Specifically, it is pointed out that in a plasma, the Prandtl number is quite small, which in turn leads to modifications in shock wave structure. (B.J.H.)

429

THE POSSIBILITY OF PRODUCING THERMONUCLEAR REACTIONS IN A GASEOUS DISCHARGE. I. V. Kurchatov. Soviet J. Atomic Energy, No. 3, 359-66(1956).

A lecture on the possibility of producing thermonuclear reactions in a gaseous discharge is reproduced. (B.J.H.)

430

INVESTIGATIONS OF PULSE DISCHARGES AT HIGH CURRENTS. L. A. Artsimovich, A. M. Andrianov, O. A. Bazilevskaya, Yu. G. Prokhorov, and N. V. Filippov. Soviet J. Atomic Energy, No. 3, 367-70(1956).

Results are presented of an experimental investigation of intense pulse discharges with rapidly increasing current. A brief description of the experimental method used is given. The pulsation processes of the plasma column are described. (auth)

431

ON THE MECHANISM BY WHICH THE CURRENT CONTRACTS IN FAST AND INTENSE GAS DISCHARGE. M. A. Leontovich and S. M. Osovets. Soviet J. Atomic Energy, No. 3, 371-4(1956).

The mechanism of the processes which take place as the current contracts under the influence of electrodynamic forces is described. (auth)

432

PENETRATING RADIATION FROM PULSE DISCHARGES. L. A. Artsimovich, A. M. Andrianov, E. I. Dobrokhotov, S. Yu. Lukyanov, I. M. Podgornyi, V. I. Sinitsyn, and N. V. Filippov. Soviet J. Atomic Energy, No. 3, 375-7(1956).

Results are presented of an investigation of the neutron radiation detected in pulse discharges in deuterium, as well as some data on the penetrating x radiation that arises in such discharges in light gases. (auth)

433

SPECTROSCOPIC STUDIES OF INTENSE PULSE DISCHARGE IN HYDROGEN. S. Yu. Lukyanov and V. I. Sinitsyn. Soviet J. Atomic Energy, No. 3, 379-87(1956).

Spectroscopic methods were used to study the properties of intense pulse discharge in a gas. It is shown that in the initial stage of the process, while the discharge is contracting onto the axis of the chamber, the velocity of the luminous front is as high as 6 to 8×10^6 cm/sec. A calculation of the number of ionized atoms is carried out. Experiments in which the luminosity of the pulse discharge plasma was investigated are described. The results of intensity measurements on the spectral lines of a hydrogen plasma are presented. (auth)

434

HARD X-RADIATION ACCOMPANYING A DISCHARGE IN A GAS. S. Yu. Lukanov and I. M. Podgornyi. Soviet J. Atomic Energy, No. 3, 389-98(1956).

It is shown that a powerful gas discharge at low pressure is accompanied by the emission of hard x-ray quanta. The radiation is observed in the discharge in various gases. The main properties of the radiation are studied, and consideration is given to a possible mechanism of origin of the effect observed. (auth)

435

CONTACT PHENOMENA IN A PLASMA. L. A. Sena and N. S. Taube (Scientific Research Inst. for Direct Current, USSR). Soviet Phys. JETP 3, 168-71(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 287-90(1956) Feb. (In Russian)

Jumps in the potential at a boundary between regions of a plasma with different concentrations and temperatures of electrons are considered from the point of view of the classical theory of contact phenomena in metals. Measurements carried out in a discharge tube with two parts of a positive column differing in their concentrations of electrons confirmed the admissibility of such a procedure. (auth)

ELECTRONS

436 AERE-Lib/Trans-752

THE VELOCITY DISTRIBUTION FUNCTION FOR ELECTRONS IN A VARIABLE ELECTRIC AND CONSTANT MAGNETIC FIELD. A. V. Gurevich. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. 104, 201-4(1955). 6p.

Equations were solved for the velocity distribution function for the elastic collision of electrons with plasma molecules or ions in non-stationary electric fields and constant magnetic fields. (F.S.)

437

THE LIFETIME OF POSITRONS ANNIHILATING IN ALUMINUM. G. Jones and J. B. Warren (Univ. of British Columbia, Vancouver, Canada). Can. J. Phys. 34, 1033-7(1956) Oct.

The absolute lifetimes of positrons decaying in aluminum

and mica have been found to be $1.7 \pm 0.4 \times 10^{-10}$ sec and $2.4 \pm 0.4 \times 10^{-10}$ sec, in accord with the determination by Bell and Graham (Phys. Rev. 90, 644(1953)) using a different technique. (auth)

438

ON THE RELATIVISTIC MOTION OF ELECTRONS IN MAGNETIC FIELDS WHEN QUANTUM EFFECTS ARE TAKEN INTO ACCOUNT. A. Sokolov (State Univ., Moscow). Nuovo cimento (10) 3, Suppl. No. 4, 743-59(1956).

439

STRUCTURE ANALYSIS BY ELECTRON DIFFRACTION. B. K. Vainshtein (Academy of Sciences of the USSR, Moscow) Nuovo cimento (10) 3, Suppl. No. 4, 773-97(1956).

The experimental techniques and theory of structure analysis by electron diffraction are reviewed. (B.J.H.)

440

DISTRIBUTION OF ELECTRONS SCATTERED BY SOLIDS. J. Arol Simpson, T. F. McCraw, and L. Marton (National Bureau of Standards, Washington, D. C.). Phys. Rev. 104, 64-8(1956) Oct. 1.

The distribution in energy and angle of 20-kev electrons scattered by thin foils of representative substances has been measured. The resolution is better than 0.1% in energy and 10^{-3} radian in angle. Data are presented for C, Al, Ni, Au of varying thicknesses, Formvar, and Al_2O_3. The effects of beam collimation and initial beam "contamination" on the angular distribution of a Cu single distribution of a Cu single crystal are demonstrated. (auth)

441

THE INELASTIC SCATTERING OF ELECTRONS FROM A COPPER OXIDE SURFACE. N. B. Gornyi (Leningrad Inst. for Electrotechnical Communication). Soviet Phys. JETP 3, 175-83(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 160-70(1956) Jan. (In Russian)

An electrical differentiation method in a spherical condenser is used to study the inelastic scattering of electrons from a copper oxide surface. Inelastically scattered electrons with discrete energy losses were observed from both monocrystalline and polycrystalline surfaces. The discrete energy losses are equal to the energies required to transfer an electron of the crystal lattice from a filled band to an allowed one. It is shown that the inelastically scattered electrons, with discrete energy losses, are produced by the same mechanism as accounts for the group of genuinely secondary electrons, of discrete energies, which had been discovered previously. (auth)

442

THE THEORY OF THE INTERACTION OF AN ELECTRON GAS WITH THE VIBRATIONS OF THE CRYSTALLINE LATTICE. V. L. Bonch-Bruevich (Moscow Electrotechnical Inst.). Soviet Phys. JETP 3, 278-84(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 342-50(1956) Feb. (In Russian)

The method of the Green's function is applied to the problem of the interaction of electrons with the phonon field. The electron energy spectrum and electron momentum spectrum at absolute zero have been computed. (auth)

GASES

443 AEDC-TN-56-12

National Bureau of Standards, Washington, D. C.

TABLES OF THERMODYNAMIC PROPERTIES OF ARGON-FREE AIR TO 15,000°K. Joseph Hilsenrath and Charles W. Beckett. Sept. 1956. 45p. (AD-98974).

The thermodynamic properties (Z = PV/RT, E/RT, H/RT, S/R, and Pressure) are given for equilibrium mixtures of dissociated and ionized molecules and atoms of the elements N_2 and O_2 having the low temperature composition of 0.78847 N_2 and 0.21153 O_2. The tabulated properties of this mixture (a close approximation to the properties of air) are given at close intervals from 2000 to 15,000°, for 41 densities spaced uniformly in log ρ/ρ_0—between 10 and 10^{-6} times the normal density. The results are based on chemical equilibria between the species O_2, O_2^+, N_2, N_2^+, NO_2, N_2O, NO, NO^+, O^-, O, O^+, O^{2+}, N, N^+, N^{2+} and electrons. The method of presentation permits later corrections for the effect of A and CO_2 and the contribution of intermolecular forces. The calculations are based on 9.758 ev as the dissociation energy of molecular N_2 and 1.45 ev as the electron affinity of atomic O. (auth)

444 LA-2055

Los Alamos Scientific Lab., N. Mex.

SERIES OF LECTURES ON PHYSICS OF IONIZED GASES. W. P. Allis, K. A. Brueckner, G. F. Chew, Harry Dreicer, M. L. Goldberger, Rolf Landshoff, Conrad Longmire, F. E. Low, Stanislaw Ulam, and K. M. Watson. Mar. 1955–June 1956. 393p. Contract W-7405-eng-36. $1.75(OTS).

Discussions on the physics of ionized gases, or plasmas, include detailed reviews on the statistical mechanics of ionized gases and waves in plasmas or plasma oscillations. Discussions on other miscellaneous topics such as plasma instability, derivations of magneto-hydrodynamics, plasma balance etc. are also included. (B.J.H.)

445 NP-6103

Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.

ELASTIC AND INELASTIC SCATTERING OF LOW VELOCITY He^+ AND Ne^+ IONS IN HELIUM AND IN NEON. Final Technical Report. W. H. Cramer. Aug. 1956. 46p. DA Project 5B99-01-004. Contract DA-01-009-ORD-422.

This report contains information obtained in research under Contract DA-01-009-ORD-216, and -370, on "A STUDY OF THE NEUTRALIZATION OF GASEOUS IONS" during the period February 27, 1953 to August 31, 1956.

A new apparatus is described which makes possible more precise measurements of both elastic and charge exchange cross sections for low energy positive ions in gases. Experimental results are presented for collisions in the energy range from 4 to 400 volts of He^+ and Ne^+ ions in He and Ne gases. Constants for potential functions are evaluated. The interaction energy for the formation of the molecular ion He_2^+ is calculated to be 3.9 ev., and for Ne_2^+, between 1.5 and 2.5 ev. It is concluded that the $HeNe^+$ ion, if formed, would probably separate if subjected to impact at thermal energies. (auth)

446 DTMB-Trans-111

ON THE SIZE OF GAS BUBBLES IN LIQUIDS. (Über die Grösze von Gasblasen in Flüssigkeiten). Robert Schnurmann. Translated by F. A. Raven from Kolloid Z. 80, 148-51(1937). 7p.

By taking a water–alcohol mixture as an example, it is found that the macroscopic sizes of the gas bubbles pressed through a filter are primarily a function of the viscosity of the liquid and not of its surface tension. A minimum bubble size corresponds to a maximum on the viscosity curve. A viscosity-bubble size curve is plotted for the range of viscosity from 0.008 cgs to 0.04 cgs. The curve shows that the bubble size increases inversely with the viscosity. Experiments are discussed; the part played by the mechanism of coalescence of the sub-visible gas bubbles is shown. The pore diameter of the filter does not effect the rough qualitative effect, as long as the points of origin of the sub-visible bubbles are close enough together to permit their collision. (auth)

447

NUCLEAR RELAXATION TIME IN INERT GASES. H. Staub (Univ. of Zürich, Switzerland). Helv. Phys. Acta 29, 246-9 (1956) July. (In German)

INSTRUMENTS

448 AD-63661

Tracerlab, Inc., Boston.

INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER. Quarterly Report No. 2 (No. 10 in the Series) [for] November 1, 1954 to January 31, 1955. Alexander Thomas. 48p. DA Project 3-99-09-022. Contract DA-36-039-SC-64519.

An anodized oxide of Ag is promising as a substitute for the PbO_2 as the high work function surface. A list of intermediate metals which may be less susceptible than Mg to forming a stable oxide surface film is proposed for the low work function surface. Low temperatures caused a severe drop in voltage and some drop in current in four battery models tested. The models returned to their original characteristics at room temperature. (For preceding period see AD-63670.) (auth)

449 AD-63670

Tracerlab, Inc., Boston.

INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER. Quarterly Report No. 1 (No. 9 in the Series) [for] August 1, 1954 to October 31, 1954. Alexander Thomas. 40p. DA Project 3-99-09-022. Contract DA-36-039-SC-64519.

Newly developed techniques of preparation of relatively large area electrode couple sheets from the point of view of cleaning the stainless steel base, anodizing, and evaporating magnesium on one side are described. The advantages of couples made in this manner over welded couples are given and a comparison of CPD measurements on both types is presented and analyzed. A new program of investigating promising insulators is discussed in detail. The importance of this program is reinforced by experimental evidence that the high voltage terminal of battery models must be potted. (auth)

450 AD-69290

Tracerlab, Inc., Boston.

INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER. Quarterly Report No. 3 (No. 11 in the Series) [for] February 1, 1955 to April 30, 1955. Alexander Thomas and Imogene DiBello. 54p. DA Project 3-99-09-022. Contract DA-36-039-SC-64519.

Two models made with quartz and mica insulation and with different electrode surfaces showed considerably less drop in voltage during low temperature tests. Experience directed towards substituting glazed Alsimag ceramic for the quartz is described. Failures in models containing halogenated plastics are documented from cold tests, operation under load, and exposure to a high dose of γ radiation. (For preceding period see AD-63661.) (auth)

451 AECU-3114

General Electric Co. General Engineering Lab., Schenectady, N. Y.

LIQUID METAL LEVEL INSTRUMENT. H. Robinson and C. R. Droms. Mar. 18, 1952. 33p. (R52GL85). $6.30 (ph OTS); $3.00(mf OTS).

The theory and design of an instrument for the measurement of liquid metal levels in enclosed tanks are presented. (W.L.H.)

452 AECU-3172

General Electric Co. General Engineering Lab., Schenectady, N. Y.

SECOND REPORT ON LIQUID METAL LEVEL INSTRUMENT. C. R. Droms. Dec. 21, 1954. Includes Supplement by C. R. Droms and P. W. Marks. Feb. 1, 1955. 93p. (R55GL1). $15.30(ph OTS); $5.40(mf OTS).

Results of additional development work on liquid-metal level indicators are given. Tests performed indicate satisfactory operation up to 1000°F. The system accuracy depended on operating conditions and ranged from 2 to 8% in the tests. (T.R.H.)

453 AERE-GP/R-1937

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A PERMALLOY STRIP MAGNETOMETER FOR FIELDS OF 5 TO 120 OERSTEDS. D. A. Gray. May 1956. 12p.

Details are given of the construction and performance of a magnetometer suitable for measuring fields of the order of 5 to 120 oersteds. The sensitive element is a thin Permalloy strip on which a "backing coil" is wound. Direct current supplied to the backing coil is varied until the field produced by the coil exactly balances the field to be measured. This condition is detected by applying an a-c signal to the coil and noting the disappearance of even harmonics produced by the Permalloy strip. An accuracy of ± 0.05 oersteds is obtained. (auth)

454 AERE-GP/R-1967

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A NUCLEAR RESONANCE DETECTOR AND MAGNETIC FIELD STABILISER. D. A. Gray. July 1956. 17p.

Constructional details are given of a nuclear resonance detector which enables magnetic fields of 1,000 to 8,000 gauss to be measured to 0.01%. The signal from such a detector may be used to stabilize the field of an electromagnet to 0.01% and particular arrangements are described which permit the stabilization of: a small electromagnet of 1-in. gap, 8-in. diameter pole face, power 500 watts and field 1,000 to 1,500 gauss; a larger variable gap magnet, pole face diameter up to 20 inches, power 3 KW and field up to 8,000 gauss. (auth)

455 BRL-1026

Ballistic Research Labs., Aberdeen Proving Ground, Md.

CURRENT-PULSE TESTING OF MAGNETIC CORES FOR DIGITAL COMPUTERS. LeRoy F. Silva. July 1956. 43p. DA Project No. 5B03-06-002.

A discussion of the principles and procedures of testing magnetic cores to be used in digital computer magnetic circuits is presented. Physical quantities to be tested are defined and the necessary pulse patterns to test these physical quantities are given. Resulting typical output waveforms and methods of plotting data are given. A description of the circuits used to generate the test pulse patterns, and descriptions of the current pulse generators, calibrating device, core handling equipment, procedures for processing the cores to avoid damage, and testing the cores are given with suggestions for the physical handling of the equipment. Switching characteristic data are given for three different metallic core materials along with reproductions of typical core output waveforms. (auth)

456 DTMB-797

David W. Taylor Model Basin, Carderock, Md.

TECHNIQUES FOR PROTECTING AND WATERPROOFING RESISTANCE WIRE STRAIN GAGES. Mills Dean, III. Mar. 1956. 36p.

New waterproofing techniques and materials for protection of strain gages and associated wiring are described.

Certain synthetic rubber compounds and two wax products have been found to be very satisfactory waterproofing materials. Techniques for the use of these materials are described in detail. In addition to providing good waterproofing, the synthetic rubber compounds afford considerable mechanical protection from turbulent water flow, underwater explosion shock, particle abrasion, and direct mechanical contact. Other potentially useful waterproofing materials, including a vinyl plastisol, are discussed. Information is given on satisfactory types of wire and cable for use with gage installations subject to water immersion. Details are presented on the dehydration and reactivation of gages that have become unusable due to absorption of moisture. Details are given for an entirely new method for protecting gages on the exposed surface of underwater ship hull plates in which connecting cables can be replaced without disturbing the strain-gage wiring. (auth)

457 IDO-14382(Del.)

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

IN-LINE INSTRUMENTATION FOR CPM. C. M. Slansky and F. M. Warzel. July 8, 1954. Changed from OFFICIAL USE ONLY with deletions July 31, 1956. 5p. Contract AT(10-1)-205. $1.80(ph OTS); $1.80(mf OTS). (CPP-54-64(Del.).

The properties of the "25" dissolver effluent and how they relate to the composition of the dissolver solution are discussed. Instruments are being investigated for measuring the viscosity of these radioactive streams. (W.L.H.)

458 MLM-1023

Mound Lab., Miamisburg, Ohio.

A REMOTE CONTROLLED QUARTZ-FIBER MICROBALANCE FABRICATION OF QUARTZ COMPONENTS. (Information Report). R. G. Olt, H. R. DuFour, M. I. Gray, and J. H. Wright. Dec. 7, 1954. 41p. Contract AT-33-1-GEN-53. $0.30(OTS).

A compilation of the principles and procedures which have been formulated for the preparation of quartz fibers and their fabrication into constituent parts of the Mound Laboratory quartz fiber microbalance is presented. Auxiliary equipment, i.e. tools, adhesives, etc., used in the construction of the quartz fiber components is described. (auth)

459 NAVEXOS-P-1248

Special Devices Center, Port Washington, N. Y.

THE PRINCIPLES OF COMPUTER SIMULATION. THEORY [AND] MAINTENANCE. 159p. Sept. 1955.

General principles of computers, individual components used in servomechanism and computer systems, and general maintenance procedures are reviewed. (F.S.)

460 AERE-Lib/Trans-685

INVESTIGATIONS ON QUARTZ FIBRES. E. Eberhardt, H. Kern, and H. Klumb. Translated by F. Hudswell from Z. angew. Phys. 3, 209-12(1951). 9p.

A method is described for the mechanical preparation of quartz fibers of any length with a constant chosen diameter in the range from 30 to 0.7 μ for radiometers of high sensitivity. Mechanical properties of these fibers are reported. (F.S.)

461 DTMB-Trans-108

ON THE SIZE OF GAS BUBBLES AND DROPLETS IN LIQUIDS. (Über die Grösze von Gasblasen und Flüssigkeitstropfchen in Flüssigkeiten). Siegfried Halberstadt and Paul H. Prausnitz. Translated by F. A. Raven from Z. angew. Chem. 43, 970-7(1930). 21p.

An apparatus is described which permits the size of gas bubbles in liquids to be measured. The size of gas bubbles which emanate from diaphragms of variable pore diameter has been studied in H_2O and ether. Variation in the size of gas bubbles produced by extrusion of gas through the same filter plate into various liquids has been determined. The effect of pressure on the size of the gas bubbles is discussed. (W.L.H.)

462 TIB/T-4535

FLASH BACK ARRESTORS OF POROUS SINTERED METALS: A NEW SAFETY DEVICE FOR EXPLOSIVE GASES. (Flammensperren aus Porosem Sintermetall). F. Frehn, W. Hotop, and G. Stempel. Translated from Schweiss. u. Schneid. 7, 198-200(1955). 7p. (AD-92143).

The advantages of flash back arrestors of porous sintered metal materials over those of porous ceramics are discussed. Their installation, in the form of discs or tubes, is explained. The advantages and disadvantages of the various materials for metal flash back arrestors are given. The protection the arrestors offer against penetration is demonstrated. (J.H.M.)

463

A VERSATILE ELECTRODE HOLDER FOR USE WITH THE HILGER STEELOSCOPE. F. P. Landis and J. R. Pelrine (Knolls Atomic Power Lab., Schenectady, N. Y.). Appl. Spectroscopy 10, No. 3, 161-2(1956).

An electrode holder for use with the Hilger Steeloscope is described. The holder may be set up with the Steeloscope as a portable unit for the spectroscopic examination of bulk metal stock of any size or shape. Unique design features are the rotatable mount for the jaw assembly and the hinged counter-electrode jaws. (auth)

464

NUCLEAR PHYSICS AND ELECTRONICS. Marcel Fiehrer (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 981-4(1955) Nov. (In French)

The types of electronic equipment used in nuclear physics measurements are surveyed. (B.J.H.)

465

DECAY LINE REGISTER USING MAGNETOSTRICTION. A. Tarabella (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 985-9(1955) Nov. (In French)

Complete circuit diagrams are given for the delay line register. (B.J.H.)

466

APPARATUS FOR CALIBRATING TIME SELECTORS. J. Mey and A. Boucherie (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 990-4(1955) Nov. (In French)

The principles of the apparatus are described, and complete circuit diagrams are given. (B.J.H.)

467

A HIGH-TEMPERATURE MICRO-THERMOSTAT FOR X-RAY STUDIES ON SINGLE CRYSTALS OF APPRECIABLE VAPOUR PRESSURE. P. J. A. McKeown (Imperial Coll., London). J. Sci. Instr. 33, 386-8(1956) Oct.

A furnace is described to heat slightly volatile specimens up to 1250° C for experiments with an x-ray single-crystal spectrometer. The thermal expansion of alumina at right angles to its hexagonal axis is found to be $L/L_0 = 1 + 6.07_4 \times 10^{-6}\ T + 1.86 \times 10^{-9}\ T^2$, up to 1230° C. (auth)

468

A SIMPLE VACUUM LEAK DETECTOR USING A RADIO-FREQUENCY MASS SPECTROMETER. P. F. Varadi and L. G. Sebestyen (Research Inst. for Telecommunication, Budapest, Hungary). J. Sci. Instr. 33, 392-4(1956) Oct.

A simple vacuum leak detector, based on the radio-frequency mass spectrometer principle is described. In the pressure range of $10^{-3} - 10^{-7}$ torr, leaks of the order of 2.8×10^{-8} l. torr/s can be detected. The instrument may also be used as a conventional ionization manometer. A

brief description of the principles and some details of the construction of the tube and of the portable electronic equipment are given. (auth)

ISOTOPES

469 AEC-tr-2647
TWO NEW ISOTOPES OF RUTHENIUM AND RHODIUM. G. B. Baro, P. Rey, and W. Seelman-Eggebert. Translated by George Watson from Publ. com. nacl. energia atomica (Buenos Aires), Ser. quim. 1, 19-28(1955). 13p.

Isobars of Ru and Rh with a mass number greater than 107 were studied. No theoretical reasons prevent their formation as fission products. The energy of their disintegration was calculated by applying the formula based on the drop model for the isotopes of Mo, Te, Ru, Rh, Pd, Ar, and Cd between the mass numbers 103 to 112. (F.S.)

470 AERE-Lib/Trans-722
THE PRODUCTION AND THE SEPARATION OF CARRIER-FREE RADIOACTIVE ISOTOPES. A. N.Murin, V. D. Nefedov, and I. A. Yutlandov. Translated by T. Turton from Uspekhi Khim. 24, 527-74(1955). 66p.

Methods are discussed for the preparation of high specific activity and carrier-free radioelements. Methods are presented for the isolation of a number of the more commonly used radioactive elements obtained by cyclotron reactions. (128 references) (C.H.)

471
ON THE ISOTOPIC CONSTITUTION OF POTASSIUM. A STUDY OF MASS DISCRIMINATION IN A HOT ANODE ION SOURCE. Carl Reuterswärd. Arkiv Fysik 11, No. 1, 1-54 (1956).

The problems in the determination of absolute isotopic abundance ratio are briefly reviewed. Detailed description of the apparatus used to study the isotopic constitution of K are included, and instrumental errors are surveyed. Results are given of measurements of the ratios K^{39}/K^{41} and K^{39}/K^{40}. (B.J.H.)

472
SOME UPPER LIMITS OF ISOTOPIC ABUNDANCE. I. A, Mn, AND Cd. Larkin Kerwin (Universite Laval, Quebec, Canada). Can. J. Phys. 34, 1080-1(1956) Oct.

473
THE PREPARATION OF ARTIFICIAL RADIOELEMENTS. C. Fisher. L'Onde Électrique 35, 898-902(1955) Oct. (In French)

Included are brief reviews on the constitution of nuclei, radioactive disintegration, nuclear reactions, formation of radioisotopes, and the chemistry of radioelements. (B.J.H.)

474
INDUSTRIAL APPLICATIONS OF THE RADIOELEMENTS. P. Leveque (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 911-15(1956) Oct. (In French)

The use of the ionizing properties of radiations, the interaction of radiation with matter, and tracer uses are reviewed. (B.J.H.)

475
A NEW HAFNIUM ISOTOPE Hf^{183}. O. O. Gatti and J. Flegenheimer. Z. Naturforsch. 11a, 679(1956) Aug. (In German)

MATHEMATICS

476 AECU-3368
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH SPEED COMPUTER. PART II. MATHEMATICAL RESEARCH AND PROGRAMMING. PART III. MATHEMATICAL ANALYTICAL PROGRAM. PART IV. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. June 1956. 18p. Contracts AT(11-1)-415; N6ori-07130; and N6ori-07124. $3.30(ph OTS); $2.40(mf OTS).

Research on circuits and design for a very high-speed computing machine is discussed. Topics such as mathematical research and programming, a mathematical analytical program, and general laboratory information on ILLIAC use and operation are discussed. (J.H.M.)

477 AECU-3369
Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. STUDY PROGRAM ON HIGH SPEED COMPUTER. PART II. MATHEMATICAL RESEARCH AND PROGRAMMING. PART III. ILLIAC USE AND OPERATION—GENERAL LABORATORY INFORMATION. July 1956. 18p. Contracts AT(11-1)-415; N6ori-07130; and N6ori-07124. $3.30 (ph OTS); $2.40(mf OTS).

Research on circuits and design for a very high-speed computing machine, including the theory of speed-independence, is discussed. Topics such as mathematical research and programming, and general laboratory information on ILLIAC use and operation are discussed. (For preceding period see AECU-3368.) (J.H.M.)

478 ANL-5634
Argonne National Lab., Lemont, Ill.
TABLE OF SIN θ AND $\sin^2\theta$ FOR VALUES OF θ FROM 2° TO 87°. H. Anne Plettinger. Mar. 1956. 45p. Contract W-31-109-eng-38. $0.35(OTS).

A table of sin θ and $\sin^2\theta$, to five decimal places for every hundredth of a degree from 2 to 87°, has been prepared for use in the studies of x-ray diffraction. (J.H.M.)

479 NYO-7690
New York Univ., New York. Atomic Energy Commission Computing Facility.
RESEARCH PROBLEMS INITIATED AT THE INSTITUTE OF MATHEMATICAL SCIENCES. Annual Summary Report [for] July 1, 1955—June 30, 1956. Oct. 1, 1956. 47p. Contract AT(30-1)-1480. $7.80(ph OTS); $3.30(mf OTS).

Brief summary descriptions of research problems, including computing problems arising in applied mathematics, are discussed. Calculations were prepared for the passage of a shock-wave over an obstruction in a channel, the solution of elliptic difference equations, complex eigenvalued differential equation, the solution of an integral, and a singular integral equation. An investigation of numerical methods tests is discussed. (J.H.M.)

480
NUMERICAL QUADRATURE OF FOURIER TRANSFORM INTEGRALS. H. Hurwitz, Jr. and P. F. Zweifel (Knolls Atomic Power Lab., Schenectady, N. Y.). Math. Tables Other Aids Computation 10, No. 55, 140-9(1956) July.

A new scheme is discussed that attempts to alleviate the difficulty of evaluating integrals when conventional methods of numerical quadrature are not suitable for evaluation of integrals when x is large. Topics such as preliminary manipulation, the choice of the number of points of evaluation, and an outline of numerical procedure are discussed. (J.H.M.)

MEASURING INSTRUMENTS AND TECHNIQUES

481 AECU-3337
Internuclear Co., Clayton, Mo.
AIRBORNE HAZARDS DUE TO INDIUM IN RADIATION REACTOR. Lawrence C. Widdoes. May 14, 1956. 5p.

A-1 Project. (IC-LCW-56-5). $1.80(ph OTS); $1.80 (mf OTS).

The maximum dose due to radioindium was calculated for an observer on the ground exposed to a hemispherical atomic cloud with uniformly distributed source moving with constant velocity and without changing size or shape. (C.H.)

482 AF-SAM-56-59

School of Aviation Medicine, Randolph AFB, Texas.
A DIRECT DETERMINATION OF THE GAMMA EMISSION FROM A Po–Be SOURCE. Henry M. Borella, Sanford C. Sigoloff, and Loren C. Logie. Dec. 16, 1955. 5p.

The gamma and neutron dose rates from Po–Be sources have been measured using the Hurst Proportional Counter and the chloroform-phase chemical dosimeters. A shift in the gamma-neutron ratio was noted in sources of different ages. In addition, the gamma field was found to be non-isotropic in the older sources. (auth)

483 ARDE(M)-2/56

Gt. Brit. Armament Research and Development Establishment, Fort Halstead, Kent, England.
AN EXPOSURE CALCULATOR FOR GAMMA-RADIOGRAPHY. R. S. Morgan. Feb. 1956. 11p. (AD-93270).

A calculator is described, which, with a single movement of the main slide, gives the exposure-factor for the radiography of steel, at any required source-film-distance, with the γ radiation from any one of the five radioactive sources at present issued for industrial radiography; viz. Tm^{170}, Ir^{192}, Cs^{137}, Rn and Co^{60}. An auxiliary slide converts exposure-factor into exposure-time for a given source-strength. Scales are incorporated for four convenient film-densities of four commonly used commercial x-ray films. The prototype calculator has proved itself a useful tool in the practice of gamma-radiography. A commercial version has been manufactured and is illustrated in the report. (auth)

484 CF-56-5-76

Oak Ridge National Lab., Tenn.
SCINTILLATION RESPONSE OF LiI(Eu) CRYSTALS TO MONOENERGETIC FAST NEUTRONS. R. B. Murray and J. Schenck. May 11, 1956. 13p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The scintillation response of LiI(Eu) crystals to monoenergetic fast neutrons has been investigated in the course of a study directed toward the development of a more versatile and efficient fast-neutron spectrometer. The scintillation response has been determined as a function of neutron energy (in the range 0.63 to 14.9 Mev), Eu concentration, Li isotope concentration, and crystal temperature. The pulse height spectra of those crystals containing Li^6 demonstrate a peak from the fast neutron induced Li^6 $(n,\alpha)t$ reaction. At room temperature the peak from fast neutrons of energies less than 6 Mev is broad and roughly rectangular in shape. A substantial improvement in the shape and resolution of the fast-neutron peak is found, however, on cooling the crystals to about –140°C. (auth)

485 HW-41325

Hanford Atomic Products Operation, Richland, Wash.
AN ALPHA ENERGY ANALYZER. Don A. Campbell. Jan. 27, 1956. 8p. Contract [W-31-109-Eng-52]. $1.80 (ph OTS); $1.80(mf OTS).

Factors affecting the performance of a gridded ionization chamber for measuring α energies are discussed. (C.H.)

486 NP-6126

Victoreen Instrument Co., Cleveland.
PHOTOCONDUCTIVE DOSE RATE INDICATOR FOR IONIZING RADIATIONS. Quarterly Progress Report No. 3 [for] May 1, 1956 to July 31, 1956. Lewis E. Hollander, Jr. 59p. DA Project 3-12-08-031. Contract DA-36-039-SC-70150.

Single CdS crystal prisms with high γ photoconductive sensitivity and properties amenable to grinding and lapping have been achieved. Crystal thickness and electrode geometry studies are reported. Crystal cleaning and ultrasonic soldering techniques are described. The study of radiation damage and changes in sensitivity over a 6-month period are presented. Tentative design and performance characteristics of a photoconductive γ-dose rate meter are presented. (T.R.H.)

487 NRL-4814

Naval Research Lab., Washington, D. C.
GAS GAIN IN THE PROPORTIONAL COUNTER. T. A. Chubb. Aug. 20, 1956. 20p.

A study of gas gain characteristics in the proportional counter at gains of 10^2 and above has been made with about 29 low-pressure gas fillings, representative of a wide selection of chemical structures. Gas gains of 10^7 to 10^8 have been achieved for single electrons with certain of the organic molecules. The data, plotted on log gain vs. voltage curves, show several facts. Excessive vapor pressure reduces the maximum gas gain which can be achieved with organic compounds without sparking. Increasing the component pressure of simple molecules, or adding a polyatomic component, permits operation at increased gain. The characteristic curves are essentially in agreement with current gas discharge theory. (auth)

488 NRL-4833

Naval Research Lab., Washington, D. C.
CALCULATED EFFICIENCIES OF NaI CRYSTALS. E. A. Wolicki, R. Jastrow, and F. Brooks. Aug. 27, 1956. 40p.

Probabilities for the interaction of gamma rays with NaI scintillation crystals have been calculated for the case of a point isotropic source situated on the axis of a cylindrical crystal. These results can be used in obtaining the absolute gamma-ray detection efficiency of a NaI scintillation counter by a method which does not require calibrated radioactive sources. Computations were made for eighteen commercially available crystal sizes and for a wide range of gamma-ray energies and source-to-crystal distances. The results are presented in both tabular and graphical form. (auth)

489 WAPD-PWR-Ph-73

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
REACTOR IRRADIATION OF STANDARD FISSION COUNTER (WL-6376). William Baer. Feb. 2, 1956. 5p. $1.80(ph OTS); $1.80(mf OTS).

The operating characteristics of a standard fission counter, examined intermittently during short interruptions of a long-time reactor irradiation, are discussed. The counter is recommended for use in the control system of long-lived reactors. (J.H.M.)

490

A SCINTILLATION CRYSTAL ROENTGEN-RAY DOSIMETER. J. W. Robson and E. C. Gregg (Case Inst. of Tech., Cleveland, Ohio). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 979-87(1956) Nov.

491

STUDIES OF NUCLEAR DISINTEGRATIONS WITH A COINCIDENCE SPECTROMETER. Tor Ragnar Gerholm. Arkiv Fysik 11, No. 1, 55-77(1956).

A spectrometer for electron-electron and electron-gamma coincidence measurements is described. Attention is called to some of its applications, namely the study of

complex nuclear disintegrations, determinations of internal conversion coefficients and branching ratios, and measurements of the lifetimes of specified nuclear levels. The experimental difficulties and the limitations encountered are discussed in some detail. The instrument has been used for the study of the following isotopes: Pb^{200}, Pb^{205}, and Tl^{200}. A new method is suggested for the measurement of very short-lived nuclear levels ($\leq 10^{-10}$ sec.) with the aid of the electron-electron coincidence spectrometer and a high-frequency transmitter. (auth)

492

IONIZATION MEASUREMENTS AT VERY HIGH ENERGY IN NUCLEAR EMULSION. H. Winzeler (Physikalisches Institut der Universität, Bern, Switzerland). Helv. Phys. Acta 29, 260-2(1956) July. (In German)

493

METHOD FOR DETERMINATION OF THE NATURAL BACKGROUND FOR GAMMA-RADIATION COUNTERS. V. L. Shashkin (Kirgiz Inst. of Geology). Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. 838-9(1956) July. (In Russian)

A method based on partial screening of gamma radiation produced in surrounding rocks by means of a cylindrical lead screen is described. The method permits determination of the natural background of the counter even in points of high radioactivity of the surrounding rocks. (R.V.J.)

494

NEW DETECTOR UNIT FOR IRRADIANCE MEASUREMENTS, UTILIZING AN INTEGRATING SPHERE AND A PHOTOMULTIPLIER TUBE. Peter L. Tea, Jr. (Washington State Coll., Pullman) and H. Dean Baker (Columbia Univ., New York). J. Opt. Soc. Amer. 46, 875-8(1956) Oct.

A detector unit of novel design is described which has been used successfully in model-chamber studies using visible light as a source of radiation, devised to find the geometric factors required for calculation of solid-to-solid radiant-heat-transfer problems. The detector unit may also be employed in investigations of interreflections in model rooms. Some of the useful properties of this detector unit are negligible cosine error, little fatigue, and linearity of response. (auth)

495

TECHNIQUES IN HIGH-RESOLUTION COINCIDENCE COUNTING. George H. Minton. J. Research Natl. Bur. Standards 57, 119-29(1956) Sept.

Circuitry, systems, and techniques used in radiation coincidence measurements with millimicrosecond resolution are discussed. An analysis of the time fluctuations in a scintillation counting system is presented and comparisons with experimental results are made. (auth)

496

AN ALINEMENT AND CO-ORDINATE SYSTEM FOR NUCLEAR EMULSION STACKS. E. Silverstein and W. Slater (Enrico Fermi Inst. for Nuclear Studies, Chicago). J. Sci. Instr. 33, 381-3(1956) Oct.

Problems of scanning, trace-through and measurement in nuclear emulsion stacks can be simplified by the use of a co-ordinate system photographed directly on to the face of each pellicle. A method of making and printing a suitable grid that intercepts less that ½% of the useful area, as well as the advantages arising from its use, are described. (auth)

497

AN INDIUM FOIL COUNTER FOR THE MEASUREMENT OF NEUTRON FLUX. D. H. Peirson (Atomic Energy Research Establishment, Harwell, Berks, England) and F. C. Loveless (Twentieth Century Electronics Ltd., Surrey, England). J. Sci. Instr. 33, 404(1956) Oct.

The measurement of thermal neutron flux by foil activation is discussed. A Geiger-Mueller counting tube has been designed with a large area In foil as cathode so that β particles leaving the surface of the In are registered with optimum collection geometry and without window absorption. (J.H.M.)

498

NEUTRON SPECTROMETER USED AT THE SACLAY PILE. M. Galula, B. Jacrot, and F. Netter (Centre d' Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 818-20(1956) Oct. (In French)

The design and use of the neutron spectrometer for the Saclay pile are briefly outlined. (B.J.H.)

499

ELECTRONIC APPARATUS FOR THE MEASUREMENT OF THE DIFFUSION LENGTH IN GRAPHITE. M. Le Baud (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 833-6(1955) Oct. (In French)

Complete circuit diagrams are given for the electronic equipment used in the measurement of diffusion length in graphite. (B.J.H.)

500

DETECTION AND MEASUREMENT OF THE RADIO-ELEMENTS. B. Grinberg (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 903-10(1955) Oct. (In French)

The properties and interactions of various radiations are reviewed. Various instruments for radiation detection are briefly described, including photographic emulsions, gas ionization chambers, and scintillation techniques. The principles of the methods of measurement are also described. (B.J.H.)

501

THE DETECTION OF NUCLEAR PARTICLES: CHOICE OF APPROPRIATE DETECTOR. A. Benoit and Y. Koechlin (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 955-73(1955) Nov. (In French)

The characteristics of various radiation detectors are first outlined, and the factors to be considered in the choice of a particular detection instrument are discussed. (B.J.H.)

502

GENERALITIES ON THE USE OF PULSE-TYPE FISSION CHAMBERS. P. Hubert (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 974-6(1955) Nov. (In French)

The operation of fission counters is briefly reviewed, and some of the results obtained with it are shown. (B.J.H.)

503

SUSPENSION COUNTING IN SCINTILLATING GELS. C. G. White and Samuel Helf (Picatinny Arsenal, Dover, N. J.). Nucleonics 14, No. 10, 46-8(1956) Oct.

Adding a gelling agent to a normal liquid-scintillation solution enables it to support 1 g of material in 22 ml of gel, yet count properties are unimpaired. Thus insoluble materials can be counted even if they emit low-energy β particles. (auth)

504

SIMPLE INSTRUMENTATION DETERMINES SEVERAL SIMULTANEOUS RADIOACTIVITIES. J. Kohl and R. E. Nather (Tracerlab, Inc., Richmond, Calif.) and V. P. Guinn (Shell Development Co., Emeryville, Calif.). Nucleonics 14, No. 10, 50-3(1956) Oct.

The design and performance of a stepping single-channel analyzer and 5-window instrument are presented. (W.L.H.)

505

FAST-NEUTRON-INSENSITIVE CHEMICAL GAMMA-RAY DOSIMETER. Sanford C. Sigoloff (Univ. of Texas, Austin). Nucleonics 14, No. 10, 54-6(1956) Oct.

Acid formation in stabilized $CHCl_3$ or tetrachloroethylene serves as a measure of γ-ray dose that is rate- and temperature-iendependent and linear to over 200,000r. Adaptation to personnel monitoring is described. (auth)

506

A SYSTEM OF FILM-BADGE INTERPRETATION. Keran O'Brien, Leonard R. Solon, and Hanson Blatz (New York Operations Office, AEC). Nucleonics 14, No. 10, 58-63 (1956) Oct.

A film-badge calibration procedure is described. Charts are presented which allow calibration, easier readings, and lower the potential for error. The density-dose curve can be accurately described by a linear function, while over the entire range it can be described by an arctangent function. (W.L.H.)

507

DARK ADAPTATION REDUCES PHOTOMULTIPLIER THERMAL NOISE. B. E. Gordon and T. S. Hodgson (Shell Oil Co., Martinez, Calif.). Nucleonics 14, No. 10, 64-5 (1956) Oct.

A photomultiplier is described which has low thermal noise and high sensitivity. The counter is acceptable as a routine analytical tool for high and low-level counting. (W.L.H.)

508

COUNTING EFFICIENCY DETERMINATIONS OF Pa^{233}. L. D. McIsaac and E. C. Freiling (U. S. Naval Radiological Defense Lab., San Francisco). Nucleonics 14, No. 10, 65-7(1956) Oct.

The Np^{237} decay and Pa^{233} growth methods are outlined for determining the Pa^{233} counting efficiency. (C.W.H.)

509

SPECIAL CdS CELLS HAVE HIGH X- AND GAMMA-RAY SENSITIVITY. Lewis E. Hollander, Jr. (Victoreen Instrument Co., Cleveland, Ohio). Nucleonics 14, No. 10, 68, 70-1(1956) Oct.

Accurate, simple and inexpensive x- and γ-ray detection can be accomplished with photoconductive cells made of CdS as CdS exhibits large conductivity changes. With such a dynamic resistance change no amplification is required, all that is needed for a complete unit is a battery, a conventional meter and a CdS cell. (W.L.H.)

510

LARGE PLASTIC WELL MAKES EFFICIENT GAMMA COUNTER. G. J. Hine and A. Miller. (V. A. Hospital and Boston Univ. School of Medicine, Mass.). Nucleonics 14, No. 10, 78(1956) Oct.

A large plastic well has proved to be useful in counting 60 to 80 ml samples containing Co^{60}. This plastic scintillator is 5 in. in diameter and 6 in. high with a well 1.5 in. in diameter and 4 in. deep, is mounted on a 6364 DuMont photomultiplier. (W.L.H.)

511

SEMI-AUTOMATIC RECORDER FOR FILAR MICROMETER EYEPIECE AND ITS APPLICATION TO TRACT MEASUREMENT. B. Stiller and F. I. Louckes, Jr. (Naval Research Lab., Washington, D. C.). Nuovo cimento (10) 4, 642-7(1956) Sept.

A differential transformer has been mounted on a filar micrometer eyepiece and has been coupled to a recording circuit, to make possible automatic recording of the hairline positions. The apparatus greatly reduces the time required to make measurements with a filar eyepiece; e.g., as when measuring the multiple Coulomb scattering of tracks in nuclear emulsions. (auth)

512

A TEST FOR THE "MEDIAN ANGLE" METHOD. U. Haber-Schaim (Univ. of Illinois, Urbana). Nuovo cimento (10) 4, 669-70(1956) Sept.

The median angle method for determining the energies of particles producing stars in photographic emulsions is applied to stars produced by protons from the Berkeley Bevatron thereby testing the procedure at 6.2 Bev. It is concluded that energy determinations are subject to large fluctuations and that the derived value of the energy is more likely to be too large than too small. (B.J.H.)

513

THE PRESENT STATUS OF CALIBRATIONS OF IONIZATION DOSEMETERS WITH HIGH-VOLTAGE X-RAYS. G. P. Barnard, E. J. Axton, D. S. C. Belcher, and A. R. S. Marsh (National Physical Lab., Teddington, England). Phys. in Med. and Biol. 1, 18-24(1956) July.

514

A PROFILE COUNTER AND ITS CALIBRATION. B. D. Corbett, R. M. Cunningham, K. E. Hainan, and E. E. Pochin (Univ. Coll. Hospital Medical School, London). Phys. in Med. and Biol. 1, 37-56(1956) July.

Procedures and equipment are described for the determination of the distribution of isotopes throughout the human body. Results are reported from measurements made following the administration of I^{131}, I^{132}, Au^{198}, Na^{24}, Cu^{64}, and Y^{90}. Problems of calibration of counting equipment are discussed. (C.H.)

515

SOME RECENT NUCLEONICS INSTRUMENTS FOR USE IN CLINICAL WORK. E. W. Pulsford (Atomic Energy Research Establishment, Harwell, Berks, England). Phys. in Med. and Biol. 1, 71-3(1956) July.

516

α-PARTICLE COUNTING BEHAVIOUR OF DIAMOND CONDUCTION COUNTERS AT FIELD STRENGTHS UP TO 200 KV cm^{-1}. K. W. Taylor (King's Coll., London). Proc. Phys. Soc. (London) A69, 593-9(1956) Aug. 1.

The general behavior of a set of eighteen diamonds of size about 1 mm^3 was examined, particularly at applied field strengths from 10 kv cm^{-1} up to 200 kv cm^{-1}. The set includes all those high resistance types usually found in a sample of gem-quality diamonds. All the specimens were found to give conduction pulses and several type 1 specimens which were hitherto classed as non-counters for field strengths below 10 kv cm^{-1}, were found to give small conduction pulses for higher field strengths. The general counting behavior was similar for all diamonds, although the magnitudes of the various effects varied over wide ranges from specimen to specimen and within each specimen. At higher applied field strengths two additional phenomena were apparent: the appearance of large pulses after a short period of counting and, on removing the applied field after a period of counting, the presence of depolarization pulses which were in the same direction as the normal counting pulses. The observed behavior of all these specimens can be explained by assuming the presence of continuous spatial variations in trap density on a microscopic scale within each specimen. The mean of these microscopic variations varies over macroscopic distances within each specimen and, also, from specimen to specimen. (auth)

517

SCINTILLATION DECAY TIMES OF ORGANIC CRYSTALS. G. T. Wright (Rhodes Univ., Grahamstown, South Africa). Proc. Phys. Soc. (London) B69, 358-72(1956) Mar. 1.

A new experimental technique is described for measuring scintillation decay times in the millimicrosecond region. The method developed uses the fact that a pulsed current, as delivered by the photomultiplier scintillation counter, produces a far greater power dissipation in a resistive load than does the same mean steady current. By measuring the

power dissipated the pulse duration, and hence the scintillation decay time, may be found. A particular advantage of this method is that stochastic fluctuations of events in the scintillation counter may be neglected. These fluctuations give the multiplier output pulse a very irregular profile and are analyzed in detail using statistical generating functions. The shapes and durations of scintillations excited in anthracene, trans-stilbene and para-terphenyl crystals are investigated. For anthracene the scintillation pulses delivered at the multiplier anode are exponential with decay times of 31 mμsec and 53 mμsec for electron and alpha particle excitation respectively. The shapes of these pulses are corrected for the effects of transit time spread in the multiplier and for the effect of self-absorption of fluorescence in the crystal to determine the true shape of the molecular scintillation. For both electron and alpha particle excitation this consists of a short initial spike of fluorescence followed by a long decay, non-exponential, component; the major part of the emission is contained in the long decay component. A qualitative analysis of the measurements for trans-stilbene and para-terphenyl shows that the scintillations from these crystals are also of this general form. These results are interpreted in terms of the description proposed previously for the scintillation process in organic crystals. This description predicts this shape for the molecular scintillation and is therefore supported by the present measurements. (auth)

518

SCINTILLATION RESPONSE OF ANTHRACENE TO 6-30 KEV PHOTOELECTRONS. J. B. Birks and F. D. Brooks (Rhodes Univ., Grahamstown, South Africa). Proc. Phys. Soc. (London) B69, 721-30(1956) July 1.

Observations have been made of the scintillation response S of a 0.2 cm thick anthracene crystal to photoelectrons of energy E = 6 to 30 kev produced by various characteristic K x rays. The responses to In^{114} and Cs^{137} internal conversion electrons were also measured, and the results reduced to a standard scale of S, and compared with other data. The (S,E) curve agrees closely with that predicted theoretically. The response curve at −65°C is identical with that at 16°C, apart from a general increase of 50% in S. The response to internal electrons is significantly greater than that to external electrons of the same low energy. Reasons are suggested for the divergent results reported by Robinson and Jentschke. The reduced response to external electrons is attributed to the escape and/or quenching of the fluorescence excitation energy at the crystal surface. These and other surface phenomena affecting the response of organic scintillators to short-range external particles are discussed. (auth)

519

DOSAGE MEASUREMENT AND INSTRUMENT CALIBRATION IN RADIOTHERAPY. Wolfgang Finck. Strahlentherapie 100, 608-12(1956) Aug. (In German)

520

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 14. GENERAL ASPECTS OF THE USE OF RADIOACTIVE ISOTOPES: DOSIMETRY. New York, United Nations, 1956. 305p. $6.50.

Refer to abstract 753.

MESONS

521 NP-6135

California. Univ., Los Angeles.

FINAL REPORT. PART I. PROPERTIES OF NEGATIVE K-MESONS. Stanley C. Freden. PART II. NEGATIVE MUON CAPTURE IN INTERMEDIATE Z ELEMENTS. Joleroy Gauger. [1956]. Included reprint: FAST TIMING OF SCINTILLATION PULSES. Harold K. Ticho and Joleroy Gauger. Rev. Sci. Instr. 27, 354-9(1956). 96p. DA Project No. 599-01-004. Contract DA-04-495-Ord-318.

The exposure of nuclear emulsions and scanning and identification of K particles are described, and the mass was found. The K-meson capture phenomena were studied. The equipment used to avoid recording useless data, the twelve-channel differential chronotron, when studying negative meson capture in intermediate Z elements was constructed and is described. The mean life values in V, Cr, and Mn were derived. Using a modified chronotron, time interval distributions due to two liquid scintillation counters were studied under various experimental conditions. (F.S.)

522

OBSERVATIONS OF DECAYS OF A POSITIVE HYPERON AND A SINGLE-CHARGE HYPERON FRAGMENT. V. V. Alpers, I. I. Gurevich, and A. P. Mishakova. Doklady Akad. Nauk S.S.S.R. 108, 207-9(1956) May 11. (In Russian)

To observe Σ^+ hyperon decay, an emulsion chamber consisting of 100 layers, 450μ thick and 10 cm in diameter, was exposed to cosmic radiation for 7 hr at 27 km elevation. To determine the bremsstrahlung, 130 tracks of horizontal μ-meson $\pi \rightarrow \mu \rightarrow e$ decay were calibrated. The μ-meson mean free path was equal to $R_\mu = (584 \pm 2.3)\ \mu$ with scattering range of ±38μ. In Ilford G-5 emulsion $R_\mu = (597 \pm 1)\mu$. Therefore, corrections were applied to determine the energy of the particles. Systematic observations of the emulsion chamber area revealed the Σ^+ hyperon decay as: $\Sigma^+ \rightarrow p + \pi^0 + Q$. The Σ^+ hyperon formation and decay are presented on a microprojection. Investigation of the emulsion indicated that the hyperon was at rest during the decay. The Σ^+ hyperon mean free path $R = 8300\mu$ agrees with the ionization bremsstrahlung $t_{ioniz} = 1.3 \times 10^{-10}$ sec. From the binary decay scheme of $\Sigma^+ \rightarrow p + \pi^0$ and the proton kinetic energy $E_p = 18.5$ Mev, a Q value of 113 ± 3.8 Mev was obtained. Thus, the Σ^+ hyperon mass value is $m_{\Sigma^+} = (2331 + 7.5)\ m_e$. A case of meson decay of a hyperon fragment with a bound Λ^0 particle instead of a neutron has been observed. The formation and decay of hyperon fragments are analyzed and microprojections are presented. The results established that the hyperon fragment is either an excited nucleus of tritium ($_\Lambda{}^4H_1^3$) or an excited ($_\Lambda{}^4H_1^4$). The most probable decay schemes are given as: $_\Lambda{}^4H^3 \rightarrow p + p + n + \pi^-$, $Q = (40 \pm 5.8)$ Mev, $E_n = 1.94$ Mev; or $_\Lambda{}^4H^4 \rightarrow H^2 + p + n + \pi^-$, $Q_1 = 40 \pm 5.8$ (Mev), $E_n = 1.62$ Mev; $Q_2 = (39.6 \pm 5.8)$ Mev, $E_n = 1.57$ Mev. The rays of the primary star were also investigated. All particles stopped in the emulsion except for one track which was obviously broken, a proton track which underwent the nuclear interaction without the emission of charged particles. (R.V.J.)

523

AN ANALYSIS OF THE SPIN AND PARITY OF THE τ-MESON. Y. Eisenberg, E. Lomon, and S. Rosendorff (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) 4, 610-30(1956) Sept.

The generality of the double angular momentum expansion for the final state in τ meson decay is pointed out. The significance of the relativistic corrections is emphasized. A relativistic analysis is made of the energy and angular distribution of 481 collected events. One or more terms of the expansion are considered. In addition, a classical analysis is made of partially integrated distributions. On the basis of the analysis it is concluded that the τ meson may have [spin, parity] of [0−], [1+] or [3+] on the basis of a weak set of assumptions concerning the interaction. If

stronger assumptions are utilized one can eliminate the [1+] case or even both the [1+] and [3+] cases. (auth)

524

DECAY MODES AND MEAN LIFE OF SCATTERED K^+-MESONS. N. N. Biswas, L. Ceccarelli-Fabbrichesi, M. Ceccarelli, K. Gottstein, N. C. Varshneya, and P. Waloschek (Max-Planck-Institut fur Physik, Gottingen, Germany). Nuovo cimento (10) 4, 631-6(1956) Sept.

The investigation described aimed at finding any possible modifications in the relative frequency ratios of the different kinds of decay modes of positive K mesons as a consequence of nuclear interactions. It has further been investigated whether a considerable number of the heavy mesons originating from nuclear interactions of K mesons have a mean life substantially shorter than that observed in attenuation experiments. The negative results of the experiment together with other experimental data recently obtained seem to create difficulties for some of the theories on the properties of the τ and θ particles. (auth)

525

DEPOLARIZATION OF STOPPED PARTICLES. W. Thirring (Universitat Bern, Switzerland). Nuovo cimento (10) 4, 666-8(1956) Sept.

Since a previously suggested search for angular correlations in τ-meson decay has shown a negative result, the question arises as to whether this indicates the absence of initial polarization or that the τ meson becomes depolarized. Some of the implications of this question are discussed briefly. (B.J.H.)

526

NEGATIVE K-PARTICLE ELASTIC SCATTERING FROM HYDROGEN. Francis C. Gilbert, Charles E. Violet, and R. Stephen White (Univ. of California Radiation Lab., Livermore and Berkeley). Phys. Rev. 103, 1825-7(1956) Sept. 15.

Three (K^-,p) scattering events have been found in following 560 cm of negative K-particle track in nuclear track emulsion. The masses of the negative K-particles as calculated from the ranges and angles of the secondaries are not inconsistent with the mass of the τ^+ particle. 1634 cm of track length from other experiments in which no (K^-,p) scatterings were observed have been added to the 560 cm of this experiment to give an elastic scattering cross section of 44 millibarns. (auth)

527

PROPERTIES OF HEAVY UNSTABLE PARTICLES PRODUCED BY 1.3-BEV π^-MESONS. R. Budde, M. Chretien, J. Leitner, N. P. Samios, M. Schwartz, and J. Steinberger (Nevis Cyclotron Labs., Irvington-on-Hudson, N. Y.). Phys. Rev. 103, 1827-36(1956) Sept. 15.

A propane bubble chamber has been exposed to a π^- beam of 1.3-Bev kinetic energy. The reactions $\pi^- + p \rightarrow \Sigma^- + K^+$, $\pi^- + p \rightarrow \Lambda^0 + \theta^0$, $\pi^- + p \rightarrow \Sigma^0 + \theta^0$, can be experimentally distinguished from carbon events. Results based on the first 55 such events are presented. The center-of-mass production distribution of the Σ^- is peaked forward, that of the Λ^0 backward. No large anisotropies in the angular correlation of production and decay were found, so that we have no evidence for spin in excess of $\frac{1}{2}$ for any of the three particles: Σ^-, Λ^0, or θ^0. A study of the relative abundance of single and double V production indicates that both Λ^0 and θ^0 have either long-lived "states" or neutral decay modes. A statistical analysis gives $\bar{\sigma}_{\Lambda 0} = 0.3_{-0.12}{}^{+0.15}$, $\bar{\sigma}_{\theta 0} = 0.3_{-0.12}{}^{+0.19}$, for the normal charged decay probabilities ($\Lambda^0 \rightarrow \pi^- + p$; $\theta^0 \rightarrow \pi^+ + \pi^-$) of the Λ^0 and θ^0, respectively. One event was analyzed to obtain the energy released in Σ^- decay. $\Sigma^- \rightarrow \pi^- + n + Q$; $Q = 118 \pm 2.6$ Mev. The Σ^- lifetime on the basis of 16 decays is $(1.4_{-0.5}{}^{+1.6}) \times 10^{-10}$ sec. (auth)

528

NO-RECOIL APPROXIMATIONS TO CHARGED SCALAR MESON SCATTERING. G. Feldman (Institute for Advanced Study, Princeton, N. J.) and P. T. Matthews (Department of Mathematical Physics, Birmingham, England). Phys. Rev. 103, 1870-3(1956) Sept. 15.

Feynman's method of functional integration is applied to meson-nucleon scattering. The scattering amplitude is obtained exactly in charged meson pair theory with neglect of nucleon recoil, and it is obtained in an approximation to linear charged meson theory with neglect of recoil. The results are the same as one obtains using the Chew-Low method. (auth)

529

OBSERVATION OF LONG-LIVED NEUTRAL V PARTICLES. K. Lande, E. T. Booth, J. Impeduglia, and L. M. Lederman (Columbia Univ., New York) and W. Chinowsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1901-4(1956) Sept. 15.

In a search for long lived neutral particles, the Columbia 36-in. magnet cloud chamber was exposed to the neutral radiation emitted from a Cu target at 68° to the 3-Bev external proton beam of the Cosmotron. Complete data are tabulated on V^0 events. (B.J.H.)

530

EVIDENCE FOR A LONG-LIVED NEUTRAL UNSTABLE PARTICLE. W. F. Fry, J. Schneps, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 103, 1904-5 (1956) Sept. 15.

During a search for K^- mesons in a pellicle stack, several events were observed in which an unstable particle originated in the emulsion from a small star which was produced by a neutral particle. Complete descriptions of the individual events are included. The events can be explained by assuming that long-lived neutral K mesons were produced at the target with about the same frequency as the K^+ mesons. (B.J.H.)

531

MESON PRODUCTION BY ELECTRONS. R. B. Curtis (Univ. of Illinois, Urbana). Phys. Rev. 104, 211-17(1956) Oct. 1.

The differential cross section for the production of mesons by electrons has been calculated to first order in the fine structure constant as a function of the meson angle and energy. It is possible to split the transition probability into two terms, one of which is proportional to the photomeson differential cross section (the Williams-Weizsäcker approximation), the other containing longitudinal current and other corrections. Experimental cross sections were used in the first term and the correction term was calculated using the Chew-Low theory. The cross section was calculated on the Illiac (the electronic digital computer at the University of Illinois) for seven electron energies from 350 Mev to 560 Mev, for meson energies at intervals of 15.5 Mev, and for meson angles of 45°, 90°, and 180° in the laboratory system. (auth)

532

THEORY OF S-WAVE PION SCATTERING AND PHOTOPRODUCTION AT LOW ENERGIES. S. D. Drell, M. H. Friedman, and F. Zachariasen (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 104, 236-48(1956) Oct. 1.

A fixed-source analysis of the s-wave pion-nucleon interaction is constructed along the lines of the Chew-Low-Wick formalism. A bilinear s-wave interaction of the form $\lambda_0 \varphi \cdot \varphi + \lambda_T \cdot (\varphi \times \pi)$ is added to the usual p-wave coupling $(4\pi)^{\frac{1}{2}} (f/\mu) \sigma \cdot \nabla_T \cdot \varphi$. Scattering equations are developed and solved in the one-meson approximation. Values for the renormalized coupling parameters λ_0 and λ are determined which give reasonable agreement with the s-wave phase shifts up to ~100-Mev pion kinetic energy. This s-wave

interaction with the parameters fixed by the scattering analysis is then applied to the discussion of the π^+ and π^0 photo-production cross sections. A Kroll-Ruderman theorem is proved for the above nonlocal interaction and it is shown that the contributions to s-wave neutral and charged photoproduction are consistent with experiment. Other experimental implications, in particular as to the possible role of π-π forces, are discussed. (auth)

533

PION AND MUON MASSES. E. Richard Cohen (Atomics International, Canoga Park, Calif.); Kenneth M. Crowe (Stanford Univ., Calif.); and Jesse W. M. DuMond (California Inst. of Tech., Pasadena). Phys. Rev. 104, 266-7 (1956) Oct. 1.

It is pointed out that if one assumes that the π^+ and π^- meson masses are equal, the π-μ mass difference combined with mesonic x-ray limits gives a much narrower limit on the π and μ masses than heretofore available. If all data are combined, the best light meson mass values are $M_\pi = (273.25 \pm 0.12)\ m_e$ and $M_\mu = (206.84 \pm 0.12)\ m_e$. (B.J.H.)

534

MASS DIFFERENCE OF Σ^4 AND THEIR ANOMALOUS MAGNETIC MOMENTS. E. C. G. Sudarshan and R. E. Marshak (Univ. of Rochester, N. Y.). Phys. Rev. 104, 267-9(1956) Oct. 1.

It would be expected that the relatively small mass difference between components of the same multiplet, such as Σ^+ and Σ^-, is due to interactions which are electromagnetic in origin. If the Σ is assumed to be a Dirac particle, the observed mass difference requires that the sum of the magnetic moments of the Σ^+ and Σ^- is positive and about 3 or 4 nuclear magnetons. Calculations are made of the various contributions to the anomalous moments. (B.J.H.)

535

MASS DIFFERENCE BETWEEN THE Σ^+ AND Σ^- HYPERONS AND THE MASS OF THE K^- MESON. W. F. Fry, J. Schneps, G. A. Snow, M. S. Swami, and D. C. Wold (Univ. of Wisconsin, Madison). Phys. Rev. 104, 270-1(1956) Oct. 1.

In a study of K^- stars in nuclear emulsion, two events were found which are interpreted as the capture of K^- mesons at rest by H. One event produced a Σ^+ hyperon and the other a Σ^- hyperon. Analysis of the tracks gives a value of $966.7 \pm 2\ m_e$ for the $\Sigma^+ - \Sigma^-$ mass difference. Results are in good agreement with previous results. (B.J.H.)

536

ISOTOPIC SPIN CHANGES IN τ AND θ DECAY. R. H. Dalitz (Univ. of Brimingham, England). Proc. Phys. Soc. (London) A69, 527-40(1956) July 1.

The decay of τ and θ particles is discussed on the hypothesis that the amplitude for an isotopic spin change of ΔT in τ θ decay to pions should decrease with increasing ΔT, the transition $\Delta T = \frac{1}{2}$ being dominant. Assuming zero spin for τ and θ, the large difference between θ^0 and θ^+ lifetimes and the τ'/τ branching ratio (predicted as 0.32) both agree well with this hypothesis. (auth)

537

ESTIMATE OF THE π^+-p SCATTERING CROSS SECTION FROM THE π^--d SCATTERING CROSS SECTION NEAR RESONANCE. Yu. A. Gol'fand (P. N. Lebedev Physical Inst., USSR). Soviet Phys. JETP 3, 300-1(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 413-14(1956) Feb. (In Russian)

MOLECULAR PROPERTIES

538 NP-6137

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 22. Oct. 15, 1956. 62p. Contract N5ori-07856.

The effect of various types of external fields on an isolated F ion was studied, in a study of the polarization effects in the F ion. The results for the single configuration ground state calculation, with the configuration interaction procedure applied to counteract the rapid deterioration of the molecular orbital approach at increasing by large internuclear distances, in the LiH molecule are given. Configuration interaction for the ground state of He were set up on the computer for a special case involving 20 configurations. Very acceptable accuracy was obtained by the configuration interaction method, but it still falls far short of perfection in the study of He configuration. The possibility of including r_{12} terms in atomic wave functions for atoms more complicated than He was considered. The work on the electronic structure of KCl and KCl with v-center is reported. An attempt was made to find a set of analytic s-orbitals which have a more significant effect on the magnetic hyperfine coupling operator than those previously considered in a study of the magnetic hyperfine structure of Li. In connection with a one-center calculation on CH_4, it was necessary to construct spherical harmonics of order up to $l = 6$ which transform as basis elements for irreducible representations of the tetrahedral group. A technique has been evolved which leads to these results in a straight-forward and efficient manner. An investigation of the band structure of MnO based on the tight binding approximation was started. (F.S.)

539 OSR-TN-56-208

Maryland. Univ., College Park. Inst. of Molecular Physics.

SCATTERING OF LOW VELOCITY MOLECULAR BEAMS IN GASES. Edward A. Mason. May 12, 1956. 37p. Contract AF18(600)-1562. (IMP-OSR-1; AD-87522).

A large number of partial and total molecular scattering cross sections have been calculated numerically for molecules obeying an exp-six potential, consisting of an exponential repulsion term and an inverse sixth power attraction term. The tabulations cover a wide range of scattering angles, energies, and potential parameters, and can be used to obtain information about intermolecular forces from the results of experiments on the scattering of low velocity molecular beams in gases. The calculations are classical throughout, and quantum effects are ignored, but an approximate formula is given for estimating where the classical calculations break down in any particular case. The use of the tables is illustrated by a comparison with Knauer's results on the scattering of beams of H_2 in mercury vapor. (auth)

540

INTERATOMIC POTENTIAL FUNCTIONS OF SODIUM AND POTASSIUM. Rufus C. Ling (Univ. of Missouri, Columbia). J. Chem. Phys. 25, 609-13(1956) Oct.

The liquid structure theory is used to interpret x-ray-diffraction measurements on liquid Na and K to find an effective interatomic potential function for pairs of Na and pairs of K atoms. This potential function predicts approximately the correct binding energy for solid Na and K, and when reinserted in the x-ray formulas predicts scattering curves at higher temperatures which are in good agreement with experiments. (auth)

NEUTRONS

541 NAA-SR-Memo-1105

[North American Aviation, Inc., Downey, Calif.]

FIRST-COLLISION PROBABILITY IN HOLLOW CYLINDERS. J. E. Garvey and R. J. Graydon. Sept. 28, 1954. 13p. $3.30(ph OTS); $2.40(mf OTS).

The analysis of first-collision probabilities (p) in hollow cylinders is extended to include p for cylinders of β

($\equiv \Sigma_{total}\ r_{ext}$) from 2 to 10 for $\alpha (\equiv r_{internal}/r_{external})$ in increments of 0.1 from 0 to 1. Curves are presented showing $p(\beta)$ for the various α and showing $p(\alpha)$ for various β. (auth)

542

DETERMINATION OF THE MEAN FREE TRANSPORT PATH OF THERMAL NEUTRONS BY MEASUREMENT OF A COMPLEX DIFFUSION LENGTH. V. Raievski and J. Horowitz (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 821-32(1955) Oct. (In French)

The theory and methods of measurement of neutron mean free paths are reviewed. The experiments for determining this quantity in graphite and heavy water are described in some detail. For heavy water at 13°C the mean free path was found to be 2.45 ± 0.07 cm, while for graphite at 20°C having a density of 1.625, it was found to be 2.55 ± 0.09 cm. (B.J.H.)

543

SLOWING DOWN OF FISSION NEUTRONS BY WATER. L. M. Barkov and K. N. Mukhin. Soviet J. Atomic Energy, No. 3, 317-19(1956).

Descriptions are given of the method and results of measurement of τ for U^{235} fission neutrons slowed down by water to energies of 1.46 ev. The value obtained was $\tau_{1.46\ ev} = 29.4 \pm 1.5\ cm^2$. (auth)

544

MEASUREMENT OF SLOWING DOWN OF NEUTRONS BY WATER IN THE ENERGY INTERVAL FROM 1.46 TO 0.025 ev. L. M. Barkov, V. K. Makaryin, and K. N. Mukhin. Soviet J. Atomic Energy, No. 3, 321-8(1956).

With the aid of an In detector the spatial distribution of resonance (E_τ = 1.46 ev) and thermal neutrons that arise as a result of the slowing down in water of the photoneutrons emitted by an Sb + Be source is measured. The age of the neutrons $\tau_{1.46}$ ev, the thermal neutron diffusion length in water, and the square of the slowing-down length $\Delta\tau$ from neutron energies of 1.46 ev to thermal energies (0.025 ev) are determined. (auth)

545

SLOWING DOWN OF FISSION NEUTRONS BY URANIUM–WATER MEDIA. L. M. Barkov, A. P. Venediktov, and K. N. Mukhin. Soviet J. Atomic Energy, No. 3, 329-33(1956).

The spatial distribution of resonance neutrons (E = 1.46 ev) which results from the slowing down of U^{235} fission neutrons emitted by a "point" source is measured for three variations of a U-H_2O lattice made of thick slugs (35 mm) of natural uranium enclosed in cadmium tubes. The absence of anisotropies in the distribution of slowed-down neutrons is demonstrated, and the values of τ determined. (auth)

546

SCATTERING OF SLOW NEUTRONS BY WATER MOLECULES. A. F. Goryunov. Soviet J. Atomic Energy, No. 3, 335-40(1956).

Perturbation theory methods are used to calculate the cross section for scattering of slow neutrons ($E_n < 0.19$ ev) by water molecules. (auth)

547

SCATTERING OF NEUTRONS BY PARA- AND ORTHO-HYDROGEN. S. I. Drozdov. Soviet J. Atomic Energy, No. 3, 341-8(1956).

The differential and total cross sections for elastic and inelastic scattering processes of neutrons by para- and ortho-hydrogen molecules are calculated. In addition to the rotational degrees of freedom of the molecule, the vibrations of the nuclei in the harmonic approximation are taken into account. The average neutron energy loss to excitation of the molecular levels is determined. (auth)

Refer to abstracts 789 and 816.

NUCLEAR PHYSICS

548 AECU-3353

Illinois. Univ., Urbana.

TABLES OF NUCLEAR REACTION KINEMATICS AT RELATIVISTIC ENERGIES. John H. Malmberg and L. J. Koester, Jr. July 10, 1953. 181p. (AD-55735). $27.30 (ph OTS); $8.10(mf OTS).

Assisted by a Joint Program of the ONR and the AEC.

The kinetic energy and angle of the outgoing particle and the incident energy of the projectile in the photoproduction of positive and negative π mesons from protons, elastic photoproduction of π mesons from deuterons, decay in flight of a π^+ meson into a $\mu^\pm$ meson and a neutrino, and the photodisintegration of the neutron were computed and tabulated. (F.S.)

549 AECU-3366

RAND Corp., Santa Monica, Calif.

THERMODYNAMIC PROPERTIES OF MIXTURES ON THE STATISTICAL MODEL. J. J. Gilvarry and W. G. McMillan. Aug. 28, 1956. 7p. For Univ. of Calif. Radiation Lab. Contract [W-7405-eng-48], Subcontract SC-101. (RM-1793-AEC). $1.80(ph OTS); $1.80(mf OTS).

A new method of deriving Brachman's results for the thermodynamic functions of the Thomas-Fermi atom is given in generalized form applicable to mixtures of electrons and light nuclei in the field of a heavy nucleus. (auth)

550 ANL-5554

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] NOVEMBER 1955 THROUGH MARCH 1956. Aug. 1956. 145p. Contract W-31-109-eng-38. $0.70(OTS).

Experimental Nuclear Physics. Modifications were made to the fast neutron chopper which permit indefinite full speed operation. The neutron velocity selector was used in making measurements of neutrons per fission in Pu^{239}, neutron cross sections for Pu^{239}, and neutron resonances in Pu^{240}. Van de Graaff generator operations are reported. The stopping cross sections of A, He, H, and air for He^+ were measured as a function of ion energy. Neutron scattering measurements made on Na and Be^9 are reported. The decay schemes of Sn^{123}, Ba^{139}, Mo^{101}, on Ni^{65} were investigated. A preliminary search for capture γ-rays in Hg^{198} using the 7.7 meter bent crystal spectrometer revealed 14 γ rays between the energies 263 and 439 kev. Results of nuclear moment measurements on Am^{241} by angular correlation are reported. Neutron transport cross section measurements were made on Cr, Fe, and Be; the observed resonances are reported. A schematic diagram of the 10-kv regulated d-c power supply constructed for use with a high-pressure proportional counter is shown. Tentative parameters for a 12.5 Bev zero-gradient, pulsed ring proton accelerator are listed. A study was made of the effects of solute concentration and dissolved gases on light output from various liquid organic scintillators. The apparatus used is described and the results are discussed. Studies directed toward the development of a more efficient plastic scintillator are reviewed. Conduction measurements were made on Plexiglas M3 in the temperature range 26 to 89.5°C. These measurements were found to be expressed by the sum of two exponentials. Mass Spectroscopy. The gaseous species evolved from the evaporation of TiO_2, Ti_2O_3, MoO_3, ZrO_2, Zr–ZrO_2, V_2O_5, and ThO_2 were identified. A Be target was bombarded by various projectile ions. The relative ion yields and masses are shown. Theoretical Physics. The probabilities of radiative transitions in the 1p shell of light nuclei are being calculated. Results were obtained for Be^8, C^{12}, and B^{11}. These results

are presented and discussed. Analyses of neutron scattering theory, Fermi particle densities, renormalizable field theory, and pion scattering were continued. (For preceding period see ANL-5498.) (D.E.B.)

551 CU-146

Columbia Univ., New York. Nuclear Physics Labs. PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1954 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 27p. Contract AT-30-1-GEN-72. $4.80(ph OTS); $2.70(mf OTS).

The successful operation of the Nevis 400-Mev synchrocyclotron neutron velocity selector is described. The crystal goniometer was completed. Details are given of the liquid Bi cell for the determination of the nonmagnetic neutron-electron interaction. The range of the neutron crystal spectrometer was increased to 9 A by using liquid air-cooled BeO and Be filters. The theory of the paramagnetic scattering of neutrons is briefly discussed. Charged particle investigations with the 36-in. cyclotron are reviewed. Instrument development is reviewed. Problems involved in construction of Al−BF_3 counters were solved, and a neutron detector using alternate layers of B and ZnS or ZnF_2 was tested. The radiations from Cr^{48}, Ca^{47}, Sb^{122}, and He^6 were studied. Neutrino experiments are briefly described. (For preceding period see CU-145.) (B.J.H.)

552 ORNL-2100

Oak Ridge National Lab., Tenn.
RADIATION FLUX TRANSFORMATION AS A FUNCTION OF DENSITY OF AN INFINITE MEDIUM WITH ANISOTROPIC POINT SOURCES. C. D. Zerby. Oct. 22, 1956. 17p. Contract W-7405-eng-26. $0.20(OTS).

The derivation is presented of a general equation used to transform the radiation current, flux, or dose rate from an anisotropic point source in an infinite homogeneous medium at a given density to the values at any density of the medium. These equations are then used to describe the method of transforming the Tower Shielding Facility data to apply at any altitude. (auth)

553

THE POSSIBILITY OF A PHASE CHANGE IN NUCLEAR MATTER. L. E. H. Trainor and W. R. Dixon (Queen's Univ., Kingston, Ont., Canada). Can. J. Phys. 34, 229-33 (1956) Mar.

The possibility is discussed that Livesey's hypothesis of a constant nuclear temperature at low excitations is indicative of a phase change in nuclear matter. (auth)

554

SHELL EFFECTS ON THE SPACING OF NUCLEAR LEVELS. T. D. Newton (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 34, 804-29(1956) Aug.

Recent measurements of resonances in slow neutron total cross sections yield good estimates of the average level spacing, D, in medium and heavy nuclei. These spacings show large variations, by factors of 10^3 to 10^5, in the region of magic numbers of nucleons. There are also variations by smaller factors between nuclei with even and odd numbers of protons or neutrons. The even−odd effect is a cooperative phenomenon; it can be approximately treated by redefining the ground state to be used for a Fermi gas model. After this correction the gas model should predict D with reasonable accuracy since it is required only to define the density of a complete set of states. The magic number variations are shown to be fitted by an improved approximation to the single-nucleon level density. This is obtained from the observed sequence of single-particle spins and the assumption that the energy interval between spin subshells is constant. Fifty-two observed spacings are fitted by a two-parameter formula with an average uncertainty factor 3. Many of the larger remaining differences between observation and the predictions of the model are qualitatively explicable as expected departures from this uniform spacing hypothesis. (auth)

555

HIGHER APPROXIMATIONS IN THE SELF-CONGRUENT FIELD METHOD OF MESON THEORY. E. L. Feĭnberg and D. S. Chernavskiĭ (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 108, 619-22(1956) June 1. (In Russian)

It is shown that the above method basically depends on the commutative properties of energy-density interaction operators. In cases when the interaction operator does not possess matrices σ and τ (the Coulomb field) a single quantum approximation produces an answer incorrect in principle (however, with e^2 it is quite near to the correct result). In calculations of the following approximations usually a correct result can be obtained. For the cases of non-commutating operators H_K, the single meson approximation, covers the basic features of the system and the sequent approximations are of small importance. It is also shown that an additional condition can be effectively used in higher approximations. (R.V.J.)

556

NUCLEAR PHOTOEFFECT DURING EMISSION OF A TRITON. F. Heinrich and H. Wäffler (Univ. of Zürich, Switzerland). Helv. Phys. Acta 29, 232-3(1956) July. (In German)

557

CALCULATIONS OF PAIR PRODUCTION PROBABILITY FOR NUCLEAR TRANSITION 0 → 0. L. N. Zyryanova and V. A. Krutov (Zhdanov Leningrad State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 312-17(1956) Mar. (In Russian)

To determine the shape of positron spectra for the nuclear transition 0 → 0 and to evaluate the probability of pair formation in non-radiative nuclear transitions, the values of positron and electron wave functions had to be considered. Tables previously calculated for β-decay relativistic wave functions of particles in the nuclear field were used. Curves are given for positron spectra for the 0 → 0 transition in the RaC′ atom at 1416 kev, for the relation of the positron spectrum shape to Z at 1422, 2022, and 2622 kev, and to the transition energy in Z = 84. Ratio curves were constructed for the complete probability of pair formation considering the nuclear field and for the probability in non-relativistic approximation. (R.V.J.)

558

INTERNAL CONVERSION IN L_1, L_2, L_3, AND M_1 AND M_2 SUBSHELLS OF ThC(Bi^{212}_{83}). E. M. Krisyuk, G. D. Latyshev, M. A. Listengarten, L. A. Ostretsov, and A. G. Sergeev. (Obraztsov Leningrad Inst. of Transportation). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 363-6(1956) Mar. (In Russian)

Conversion coefficients in L_1, L_2, L_3, and M_1, M_2 subshells of the ThC(Bi^{212}) nuclear γ transition at 239.9 kev were investigated, and measurements were made on the "ketron" spectrometer. To obtain more accurate results, an attempt was made to achieve complete separation of the corresponding conversion lines. A comparison of experimentally obtained rates L_1: L_2: L_3 with the theoretical ratios for γ transitions with $h\nu$ = 237.9 kev in ThC(Bi^{212}) indicated that it is a purely dipole transition. The results showed the effectiveness of the method in determination of the multiplicity of γ radiations by the magnitudes of the L_1:L_2:L_3 ratio. (R.V.J.)

559

RECIPROCITY LAW FOR X-RAYS. PART I. VALIDITY FOR HIGH-INTENSITY EXPOSURES IN THE NEGATIVE REGION. Margarete Ehrlich (National Bureau of Standards,

Washington, D. C.) and William L. McLaughlin (U. S. Army Signal Corps, Fort Monmouth, N. J.). J. Opt. Soc. Amer. 46, 797-800(1956) Oct.

A 50-kv Be window x-ray tube was used to confirm the validity of the reciprocity law for x-radiation over an exposure rate range from approximately 0.033 r/sec to approximately 1100 r/sec for the ascending branches of the characteristic curves of two widely used radiation monitoring films. A fast rotary shutter producing pulses of ten microseconds in duration facilatated the coverage of this 1:30,000 range. Conventional x-ray development as well as surface and internal development were employed. From the absence of reciprocity-law failure in the ascending branches of the characteristic curves the conclusion is drawn that, under the present experimental conditions, luminescence does not compete with the photographic effect. (auth)

560

RECIPROCITY LAW FOR X-RAYS. PART II. FAILURE IN THE REVERSAL REGION. Margarete Ehrlich (National Bureau of Standards, Washington, D. C.). J. Opt. Soc. Amer. 46, 801-4(1956) Oct.

Experimental data are presented that show the reversal behavior of the characteristic curves for one commercial x-ray film as a function of x-ray exposure rate and establish the presence of reciprocity-law failure and intermittency effect in the reversal region. Under the present experimental conditions, lower exposure rates of x-radiation are seen to favor reversal while the opposite is shown to be the case for visible light. Earlier work with different types of emulsions and under different developing conditions mentions an effect with visible light similar to the one here obtained with x rays; however, a satisfactory interpretation of the basic mechanisms involved is still lacking and further experiments are required to establish the connection between the effects of x rays and visible light. (auth)

561

MAGNETIC RESONANCE. Jean Combrisson (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1101-7(1955) Nov. (In French)

The classical and quantum theories of electronic paramagnetism are briefly reviewed. Some of the results of experiments on magnetic resonance are also reviewed. (B.J.H.)

562

THE COMPETITION BETWEEN NUCLEAR SHELLS IN MAYER'S MODEL. Nissan Zeldes (Hebrew Univ. of Jerusalem, Israel). Nuclear Phys. 2, 1-64(1956) Sept.

Some regularities in nuclear shell filling and in nuclear energy level systematics are explained in Mayer's single-particle model. (auth)

563

INTERACTION OF ULTRA HIGH ENERGY PARTICLES WITH NUCLEONS AND ATOMIC NUCLEI. N. A. Dobrotin, G. T. Zacepin, S. I. Nikol'skii, and G. B. Hristiansen (Academy of Sciences of the USSR and State Univ., Moscow). Nuovo cimento (10) 3, Suppl. No. 4, 635-51(1956).

A short review is presented of some of the experiments of Soviet physicists on extensive air showers. Cascade theories of the showers are discussed, as is the use of hodoscopes in the detection of air showers. The application of air shower data to deductions concerning the interaction of ultra high-energy particles with nucleons and atomic nuclei is reviewed. (B.J.H.)

564

ON DYNAMICALLY DEFORMABLE FORM FACTORS IN THE THEORY OF ELEMENTARY PARTICLES. M. Markov (Academy of Sciences of the USSR, Moscow). Nuovo cimento (10) 3, Suppl. No. 4, 760-72(1956).

565

ABOUT THE POSSIBLE ANNIHILATION MODE OF A NUCLEON-ANTINUCLEON SYSTEM INTO A K-$\bar{K}$ PAIR. R. Gatto (Univ. of Rome). Nuovo cimento (10) 4, 526-30(1956) Sept.

The selection rules for annihilation of a nucleon-antinucleon system into a K-antiK pair which are due to conservation of angular momentum, parity (P), particle-antiparticle conjugation quantum number (C), and G quantum number conservation are discussed. It is shown that, in the framework of the Lee-Yang suggestion of a parity conjugation invariance, two new quantum numbers (called E and F) can be constructed, which give rise to additional selection rules. (auth)

566

THEORY OF MULTIPLE BOSON PRODUCTION. Y. Takahashi (State Univ. of Iowa, Iowa City). Nuovo cimento (10) 4, 531-48(1956) Sept.

A general formula for multiple boson production is derived. The introduction of a statistical idea to the general formula will be made. Neither comparison to experimental data nor interpretation of them will be given, but the discussion is restricted to the treatment of the several theories proposed so far from a unifying view point; particularly the field theoretical foundation of Fermi's statistical theory will be discussed in detail. (auth)

567

HOLES AND PARTICLES IN SHELL MODELS. D. M. Brink and G. R. Satchler (Clarendon Lab., Oxford, England). Nuovo cimento (10) 4, 549-57(1956) Sept.

The study of nuclear and atomic shell models involves the calculation of matrix elements of operators between many-body configurations. This paper shows how the occupation number representation of Dirac can be used in such calculations, especially for configurations near closed shells. Methods for the construction of many-body wave functions are given, and the equivalence of holes and particles discussed. Application is made to the calculation of transition matrix elements for holes and particles and to the investigation of two body interactions. In particular the interaction between holes and particles is considered. (auth)

568

ON THE EXISTENCE OF A BOUND NUCLEON-Λ^0 STATE. G. H. Derrick (Univ. of Sydney, Australia). Nuovo cimento (10) 4, 565-70(1956) Sept.

A variational method is used to find an upper limit to the strength of the nucleon-Λ^0 force from the measured binding energy of the hyper-triton. The force so found is too weak to lead to a bound nucleon-Λ^0 state. (auth)

569

ON THE REAL PART OF THE COMPLEX POTENTIAL WELL OF THE NUCLEUS. A. Kind (Univ. of Copenhagen, Denmark) and L. Jess (Istituto di Fisica dell'Università, Padova). Nuovo cimento (10) 4, 595-600(1956) Sept.

Starting from a well-defined assumption about nuclear forces, the real part of the complex potential which enters into the description of the neutron-nucleus interaction is determined for energies of the incoming neutron ranging from 0 to 400 Mev. The assumption is made that nuclear matter remains unperturbed as the neutron passes through it. The exchange character of nuclear forces is essential for the results obtained. (auth)

570

ON THE VALIDITY OF THE WILLIAMS-WEIZSÄCKER METHOD AND THE PROBLEM OF THE NUCLEAR INTERACTIONS OF RELATIVISTIC μ-MESONS. D. Kessler (Ecole Normale Superieure, Paris) and P. Kessler (Institut

Henry Poincare, Paris). Nuovo cimento (10) 4, 601-9(1956) Sept.

After discussing arguments which have been put forward against the application of the semi-classical Williams-Weizsäcker method to the problem of the nuclear interactions of relativistic μ mesons, a new treatment is developed which is consistent with quantum field theory. Results agree with Williams' and Weizsäcker's, in the sense that the μ meson and photon cross sections can be compared for corresponding processes by means of an "equivalent photon spectrum", almost the same in both theories. It is shown that in those non-elastic photonuclear processes the angular deviation of the μ meson is not uniquely related to primary energy and energy-transfer. It is in most cases of practical interest much smaller than in the elastic Coulomb scattering. (auth)

571

IONIZATION AT THE ORIGIN OF AN ELECTRON PAIR OF VERY HIGH ENERGY. W. Wolter and M. Miesowicz (Institute for Nuclear Physics, Kracow, Poland). Nuovo cimento (10) 4, 648-50(1956) Sept.

A report is given of ionization measurements on a single electron pair which is the beginning of a large electron-photon cascade which at the distance of ~2.5 cascade units contains ~70 electron tracks of energies greater than 10^8 ev. The coefficient of the exponential distribution of gap lengths in the track was used as a measure of the ionization. (B.J.H.)

572

NUCLEAR MOMENTS OF INERTIA DUE TO NUCLEON MOTION IN A ROTATING WELL. D. R. Inglis (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 1786-95 (1956) Sept. 15.

A model of a deformed nucleus in which the spheroidal collective field is steadily cranked about a fixed axis, as introduced in previous papers, serves as a convenient approximation expected to reproduce some of the dynamic inertial properties of the collective motion. The independent-nucleon behavior in a rotating harmonic oscillator potential, deformed by the presence of the open-shell nucleons, gives the rigid-rotation moment of inertia and is discussed here with an attempt at graphic clarity. This result is much larger than observed and attention is here focused on the shortcomings of the harmonic oscillator approximation, although, as suggested by Bohr and Mottleson, the discrepancy may also be largely due to the internucleon interactions which have not been calculated adequately and are here neglected. The 1d–2s shell is treated as a tractable illustrative case. The characteristic harmonic-oscillator degeneracy of the undeformed levels within the magic-number groups, such as the 1d and 2s levels, profoundly affects the perturbation calculation of the moment of inertia through the energy denominators. Removing this degeneracy by lowering the states of high l (as required in heavier nuclei for the magic numbers) has the effect of increasing the calculated moment of inertia above the rigid-rotation value in most cases near the beginning of the shell and reducing it in most cases near the end of the shell. The preponderance of prolate deformations is also discussed. (auth)

573

COULOMB EXCITATION OF ELEMENTS OF MEDIUM AND HEAVY MASS. R. H. Davis, A. S. Divatia, D. A. Lind, and R. D. Moffat (Univ. of Wisconsin, Madison). Phys. Rev. 103, 1801-11(1956) Sept. 15.

Yields of γ rays from thick targets of In, I^{127}, Ta^{181}, $Re^{185,187}$, $Ir^{191,193}$, $Hg^{198,199,200,202}$, Th, and U were investigated under proton or alpha-particle bombardment in the energy range 2 to 4 Mev. By using the theory for electric excitation, reduced matrix elements for all electrically excited radiations were computed and compared with single-particle estimates. The results are interpreted in terms of the strong-coupling collective model of Bohr and Mottelson and compared with the systematic trends in the region of the closed shell at 126 neutrons. A 512-kev γ ray excited in In by proton bombardment must result from a nuclear reaction. From excitation curves, γ rays in I^{127} at 60, 208, 392, 438, 631, 751, and 941 kev appear to arise from Coulomb excitation. No cascade radiations are observed. The radiations from Ta, Re, Ir, and Hg show the effects of a transition from the strong collective rotational motion to a collective vibrational nuclear motion or single-particle excitation as one approaches the closed neutron shell. Only the first excited states of Th^{232} and U^{238} were excited with alpha particles. No evidence for other levels was observed with proton excitation. The results agree within experimental error with other excitation measurements and with radiative lifetime measurements. (auth)

574

BREMSSTRAHLUNG AND PAIR PRODUCTION IN CONDENSED MEDIA AT HIGH ENERGIES. A. B. Migdal (Academy of Sciences of U.S.S.R., Moscow). Phys. Rev. 103, 1811-20(1956) Sept. 15.

The effect of multiple scattering on bremsstrahlung and pair production is considered. The probability of these processes decreases considerably at energies $\gtrsim 10^{13}$ ev. The calculations are carried out with the aid of the density matrix. The formulas thus obtained yield the probability of pair production and bremsstrahlung for arbitrary electron and photon energies. (auth)

575

FORMATION OF POSITRONIUM IN SOLIDS. S. D. Warshaw (Hebrew Univ., Jerusalem). Phys. Rev. 104, 21-2(1956) Oct. 1.

It is pointed out that several results of experiments on positron annihilation in solids are quantitatively consistent with the assumption of positronium formation and subsequent conversion between the singlet and triplet states. (auth)

576

RADIATIVE CAPTURE OF ORBITAL ELECTRONS. R. J. Glauber and P. C. Martin (Harvard Univ., Cambridge, Mass.). Phys. Rev. 104, 158-75(1956) Oct. 1.

A theory is developed of the continuous radiation spectrum which accompanies nuclear capture of atomic electrons. It is shown that quantitative predictions of the spectrum intensities must take into account the influence of the electrostatic field of the nucleus on the radiation process. This is accomplished by evaluating and making use of a particularly simple form of the Green's function for electron propagation in a Coulomb field. In a first approximation which treats the atomic electrons nonrelativistically, the spectra radiated by electrons captured from S-states are shown at all energies to have the form $x(1-x)^2$, where $x = E/E_{max}$. Radiative capture of electrons from P-states is shown to produce a spectrum which becomes extremely intense at low energies, where it merges continuously with the characteristic x-ray spectrum. Certain relativistic corrections to the S-state radiative capture probabilities are evaluated and shown to bring about an energy-dependent reduction of the intensities of the corresponding spectra. Functions are tabulated from which the spectra for allowed capture from various orbital states of any element may be determined. The calculated spectra are found to be in satisfactory agreement with those observed experimentally. In particular, the unexpectedly high intensities found at low γ-ray energies are explained by the radiatively induced capture of electrons from P states. (auth)

577

PHOTODISINTEGRATION OF THE DEUTERON BY MESON

REABSORPTION. Robert R. Wilson (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 104, 218-19(1956) Oct. 1.

A calculation is made of the photodisintegration of the deuteron which is caused by a meson being photoproduced on one of the nucleons of the deuteron and then subsequently being reabsorbed by the two nucleons. The measured photomeson production cross sections in hydrogen are separated into S-wave and P-wave parts so that the production of mesons on the neutron can be computed. The probability of meson reabsorption after production is taken as 0.11; this value results from Austern's calculation of the effects of P-state mesons. The effect of virtual production and reabsorption of S-state mesons even below the meson threshold is shown to be very important. Calculated values of the total cross section agree rather well with the experimentally measured cross sections. (auth)

578

ELECTROMAGNETIC PROPERTIES OF THE DEUTERON. EXCHANGE CURRENT CONTRIBUTIONS TO ELECTRON-DEUTERON SCATTERING AT HIGH ENERGIES. Jeremy Bernstein (Harvard Nuclear Lab., Cambridge, Mass.). Phys. Rev. 104, 249-53(1956) Oct. 1.

The analysis of high-energy electron-deuteron scattering depends on a knowledge of the two-nucleon charge density. This is proportional to the square of the two-body amplitude if meson exchanges are neglected. If these are included one may derive an effective charge density operator as an expansion in the number of mesons exchanged. Our work shows that the one-meson part of this operator can give a contribution of several percent to the differential cross section for electron-deuteron scattering at large angles and high energies. (auth)

579

QUESTION OF PARITY CONSERVATION IN WEAK INTERACTIONS. T. D. Lee (Columbia Univ., New York) and C. N. Yang (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 254-8(1956) Oct. 1.

The question of parity conservation in β decays and in hyperon and meson decays is examined. Possible experiments are suggested which might test parity conservation in these interactions. (auth)

580

THE ALPHA-PARTICLE AND SHELL MODELS OF THE NUCLEUS. J. K. Perring and T. H. R. Skyrme (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 600-9(1956) Aug. 1.

It is shown that it is possible to write down α-particle wave functions for the ground states of Be^8, C^{12}, and O^{16}, which become, when antisymmetrized, identical with shell-model wave functions. The α-particle functions are used to obtain potentials which can then be used to derive wave functions and energies of excited states. Most of the low-lying states of O^{16} are obtained in this way, qualitative agreement with experiment being found. The shell structure of the 0^+ level at 6.06 Mev is analyzed, and is found to consist largely of single-particle excitations. The lifetime for pair production is calculated, and found to be comparable with the experimental value. The validity of the method is discussed, and comparison made with shell-model calculations. (auth)

581

THE MAGNETIC MOMENTS OF ODD-ODD NUCLEI. C. A. Caine (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A69, 635-9(1956) Aug. 1.

An attempt was made to calculate the magnetic moments of odd-odd nuclei and to justify the empirical rule used in the calculation. It is assumed that each separate odd-group of nucleons retains those properties which it displays when associated with an even-group and that the g factors of the separate odd-groups are given by those of the neighboring odd A nuclei. (F.S.)

582

COLLECTIVE MOTIONS AND NUCLEAR REACTIONS. Marcos Moshinsky. Rev. mex. fis. 5, 1-41(1956) Apr. (In Spanish)

An attempt is made to give a unified discussion of the influence of collective motions on nuclear reactions. Included are discussions on the nature of collective motions and their interactions with incident nucleons, perturbation methods for the study of the inelastic scattering of nucleons by collective motions, a Tamm-Dancoff approach to collective effects, and a survey of the main conclusions. (B.J.H.)

583

THEORETICAL DETERMINATION OF THE NEUTRON REACTION CROSS SECTION BY THE OPTICAL NUCLEAR MODEL. P. Mittelstaedt. Z. Naturforsch. 11a, 663-76 (1956) Aug. (In German)

584

THE REACTION $p + p \rightarrow \pi^0 + p + p$ IN THE RANGE 400-660 MEV. L. M. Soroko. Soviet Phys. JETP 3, 184-90(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 296-303(1956) Feb. (In Russian)

The energy-dependence of the differential cross section for emission of γ-rays, coming from the decays of π^0-mesons produced in the process $p + p \rightarrow \pi^0 + p + p$ is measured at 90° in the center of mass system. An analysis is made of the way in which a resonance in the $T = 3/2$, $I = 3/2$, $l = 1$ state might appear in the energy range in this reaction. (auth)

585

NUCLEOMESODYNAMICS IN STRONG COUPLING. I. APPROXIMATE METHOD. SPIN-CHARGE MOTION. S. I. Pekar (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 3, 205-15(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 304(1956) Feb. (In Russian)

In the approximation of infinitely heavy nucleons and strong interaction with the meson field, an approximate method and the associated mathematical apparatus which makes possible explicit determination of the wave functions and energy eigenvalues of the system are developed. The mesons are assumed to be pseudoscalar, the coupling to be symmetric pseudovector (gradient) coupling, and the nucleon is assumed to be an extended source. Using the approximation method, the Hamiltonian of the system is simplified, and the spin-charge part of the system wave function is separated off and determined along with the corresponding energy. (auth)

586

COMPARISON OF STABILITY OF NUCLEAR SHELLS AND SUBSHELLS. V. A. Kravtsov (M. I. Kalinin Leningrad Polytechnical Inst.). Soviet Phys. JETP 3, 297-300(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 408-11 (1956) Feb. (In Russian)

In an attempt to compare the stability of various nuclear shells and subshells a study was made of the jumps in curves of the separation energy of α particles in light and medium nuclei. Results are shown in tabular form. (B.J.H.)

587

THE CONSERVATION OF ISOTOPIC SPIN AND THE SCATTERING OF ANTINUCLEONS BY NUCLEONS. I. Ya. Pomeranchuk (Academy of Sciences, USSR). Soviet Phys. JETP 3, 306-7(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 423(1956) Feb. (In Russian)

588

THE CONSERVATION OF ISOTOPIC SPIN AND THE CROSS SECTION OF THE INTERACTION OF HIGH-ENERGY π-MESONS AND NUCLEONS WITH NUCLEONS. L. B. Okun'

and I. Ya. Pomeranchuk (Academy of Sciences, USSR). Soviet Phys. JETP 3, 307-8(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 424(1956) Feb. (In Russian)

589

CHIMIE PHYSIQUE NUCLEAIRE APPLIQUEE (APPLIED NUCLEAR PHYSICAL CHEMISTRY). Jacques Errera. Paris, Masson & Co., 1956. 226p. (In French)

The first part of the work consists of a review of the general ideas on the atom, the nucleus, and nuclear reactions. A detailed study is also given on fission and nuclear fusion reactions. A brief study is given on nuclear reactors and the production of useful energy, either to supplement other combustibles or as a means of destruction. The second part summarizes the physical-chemical applications of nuclear radiations and the necessary techniques for utilizing them. Among these, discussions are given of radiation detectors, units of measurement, preparation of radioisotopes, and the precautions to take in their use. A series of examples is included. (tr-auth)

590

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 4. CROSS SECTIONS IMPORTANT TO REACTOR DESIGN. New York, United Nations, 1956. 357p. $7.50.

591

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 2. PHYSICS: RESEARCH REACTORS. New York, United Nations, 1956. 471p. $8.00.

NUCLEAR PROPERTIES

592 AECU-3118

Los Alamos Scientific Lab., N. Mex.

RELATIVISTIC TABLES OF ENERGY AND ANGLE RELATIONSHIPS FOR THE $T(p,n)He^3$, $D(d,n)He^3$ AND $T(d,n)He^4$ REACTIONS. L. Blumberg and S. I. Schlesinger. May 1956. 289p. Contract W-7405-eng-36. $1.50(OTS).

593 CRRP-623

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

FAST FISSION FACTOR EXPERIMENTS; REACTOR CORE CONFERENCE, JANUARY 9 TO 12, 1956. G. C. Hanna and P. R. Tunnicliffe. Jan. 4, 1956. 8p.

An experimental method is described which consists of pile irradiating natural and depleted U foils and comparing their fission product gamma activity. A scintillation counter employing two back-to-back NaI crystals was used for gamma detection. (D.E.B.)

594 KAPL-M-CJH-2

Knolls Atomic Power Lab., Schenectady, N. Y.

THE PUNCHED-CARD LIBRARY OF CROSS SECTIONS AT KAPL. Celesta J. Hibbert. [1955?]. 70p. Contract [W-31-109-Eng-52]. $10.80(ph OTS); $3.90(mf OTS).

Tables of values of absorption, fission, scattering, and transport cross sections and lethargy values for reactor materials are presented. (D.E.B.)

595 UCRL-3475

California. Univ., Berkeley. Radiation Lab.

NUCLEAR INTERNAL MOMENTUM DISTRIBUTION. John M. Wilcox. July 20, 1956. 8p. Contract W-7405-eng-48. $1.80(ph OTS); $1.80(mf OTS).

The results of previous investigations on nuclear internal momentum distributions are considered. By eliminating a restriction due to assumed background, the observed distribution is found to be Gaussian with a 1/e value of 22 Mev. The use of momentum distributions in interpreting the results of other experiments is discussed. (auth)

596 UCRL-4713

California. Univ., Livermore. Radiation Lab.

A NEW EMPIRICAL MASS EQUATION. II. ATOMIC MASSES OUTSIDE THE FISSION-PRODUCT REGION. Harris B. Levy. July 10, 1956. 13p. Contract W-7405-eng-48. $0.20(OTS).

In a previous report a new empirical equation for atomic masses was developed and presented. In that report it was shown that the new equation could be fitted to measured masses in the fission-product region, extending from Cu to Gd, with a high degree of success. The present report presents the results of attempts to extend this mass equation to mass regions both heavier and lighter than the fission-product region. (auth)

597 AERE-Lib/Trans-680

A UNIVERSAL SCHEME FOR THE OBSERVATION OF MAGNETIC RESONANCE IN ATOMIC NUCLEI. S. D. Gvozdover and N. M. Ievskaya. Translated by V. Beak from Z. Eksptl.' i Teoret. Fiz. 25, 435-40(1955). 9p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2013.

598

VIRTUAL LEVEL OF STRIPPING-REACTIONS. O. Hittmair (Univ. of Sydney, Australia). Acta Phys. Austriaca 10, No. 3, 255-60(1956). (In German).

599

THE RESONANT ABSORPTION OF γ-RAYS BY N^{14}. Geo. M. Griffiths (Univ. of British Columbia, Vancouver). Can. J. Phys. 34, 339-40(1956) Mar.

A thick target containing 65% was bombarded with 700-kev protons. The target was sufficiently thick that the protons did not leave it until reduced to about 420 kev or less, so that with little error the γ-ray yield corresponded to the full integral over the 554-kev resonance. The inverse resonant absorption of the 8.06-Mev γ rays in N^{14} was detected using a glass proportional counter filled to a pressure of 1 atm. with N_2 gas and operated with a gas amplification of 10. Typical proton and γ-ray spectra are shown. (L.M.T.)

600

THE DECAY OF W^{181}. P. Debrunner, E. Heer, W. Kündig, and R. Rüetschi (Physikalisches Institut der ETH, Zürich, Switzerland). Helv. Phys. Acta 29, 235-7(1956) July. (In German)

601

QUADRUPOLE WIDENING OF THE NUCLEAR INDUCTION OF Cl^{35} IN LIQUID COMPOUNDS. P. Diehl (Univ. of Basel, Switzerland). Helv. Phys. Acta 29, 219-21(1956) July. (In German)

602

A DIRECT DETERMINATION OF THE RESONANCE WIDTH OF $Al^{27}(p,\gamma)Si^{28}$ AT 991 KEV. F. Bumiller, J. Müller, and H. H. Staub (Univ. of Zürich, Switzerland). Helv. Phys. Acta 29, 234(1956) July. (In German)

603

TOTAL CROSS SECTION AREA OF N^{15} FOR NEUTRONS IN THE ENERGY RANGE OF 2.8 TO 3.3 MEV. H. Baumgartner, W. Franzen, P. Huber, L. Schellenberg, and F. Seiler (Physikalisches Institut der Universität, Basel, Switzerland). Helv. Phys. Acta 29, 255-6(1956) July. (In German)

604

As^{75} PURE QUADRUPOLE RESONANCE IN SYNTHETIC CLAUDETITE. P. J. Bray and George O'Keefe (Rensselaer Polytechnic Inst., Troy, N. Y.) and R. G. Barnes (Univ. of

Delaware, Newark). J. Chem. Phys. 25, 792-3(1956) Oct.

The quadrupole resonance in the prepared claudetite sample was measured and compared with arsenolite as a function of temperature. (T.R.H.)

605

THE LEVELS OF ^{19}F FROM INELASTIC NEUTRON SCATTERING. Joan M. Freeman (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 591-604(1956) July.

The gamma rays following inelastic neutron scattering in F^{19} have been studied as a function of neutron bombarding energy up to 2.2 Mev. The gamma-ray spectra in coincidence with radiation from the lowest excited levels, at 111 and 196 kev, have also been measured near the thresholds for excitation of the higher levels. The following gamma rays have been found: 1.236 ± 0.012 and 1.356 ± 0.012 Mev, in coincidence with 111-kev radiation; 1.360 ± 0.012 Mev, in coincidence with 196-kev radiation; 1.472 ± 0.016 Mev corresponding to a ground-state transition. The results are interpreted in terms of F^{19} levels at 1.557, 1.466 and 1.346 Mev. Branching ratios for the decay of each level to the ground, 111-kev and 196-kev states have been examined. No other levels up to 2.0 Mev have been found. (auth)

606

THE DISINTEGRATION ENERGY OF ^{51}Cr. J. B. Van der Kooi and H. J. Van den Bold (Rijksuniversiteit Utrecht, Netherlands). Physica 22, 681-2(1956) Aug.

An investigation of the disintegration energy of Cr^{51}, by detecting and measuring the relative intensity of the internal bremsstrahlung spectrum of the main branch, is discussed. (J.H.M.)

607

NEUTRON RESONANCE MEASUREMENTS OF Ag, Ta, AND U^{238}. R. G. Fluharty, F. B. Simpson, and O. D. Simpson (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev. 103, 1778-86(1956) Sept. 15.

Transmission measurements of Ag, Ta, and U^{238} cross sections have been made with a resolution of 0.17 to 0.05 μsec/meter, and resonance parameters are presented in the energy region from 10 ev to roughly 300 ev. A brief description of the Materials Testing Reactor fast chopper and its performance characteristics is included, and the resolution is demonstrated by resolving new resonances in Ta. Area analysis methods have been used with the primary objective being to determine values of $\overline{\Gamma}_n{}^0/D$. The values obtained are: Ag^{107}, $(0.40 \pm 0.16) \times 10^{-4}$; Ag^{109} $(0.82 \pm 0.4) \times 10^{-4}$; Ta^{181}, $(1.7 \pm 0.3) \times 10^{-4}$; and U^{238}, $(1.55 \pm 0.5) \times 10^{-4}$. These results agree reasonably well with values previously reported. (auth)

608

SPINS OF RUBIDIUM ISOTOPES OF MASSES 81, 82, 83, AND 84. J. P. Hobson, J. C. Hubbs, W. A. Nierenberg, H. B. Silsbee, and R. J. Sunderland (Univ. of California, Berkeley). Phys. Rev. 104, 101-6(1956) Oct. 1.

The nuclear spins of four neutron-deficient isotopes of Rb have been determined by the atomic-beam magnetic-resonance method. The isotopes, with half lives between 4.7 hours and 80 days, are produced in quantities of 10^{13} to 10^{14} atoms by alpha spallation reactions in the Berkeley 60-inch cyclotron. Detection of the beam is accomplished by allowing the neutral beam to fall on a sulfur surface at room temperature, then removing the surface from the apparatus and counting with low-background high-efficiency scintillation counters which accept K x rays accompanying K capture and internal conversion. Since all four isotopes are made in one bombardment, the identification is important (and is the subject of a separate discussion). The experimental results are: Rb^{81}, I = 3/2; Rb^{82}, I = 5; Rb^{83}, I = 5/2; Rb^{84}, I = 2. (auth)

609

SCATTERING OF PROTONS FROM C^{12}. C. W. Reich, G. C. Phillips, and J. L. Russell, Jr. (Rice Inst., Houston, Tex.). Phys. Rev. 104, 143-53(1956) Oct. 1.

The elastic scattering of protons from C in the range of bombarding energies 1.5 to 5.5 Mev has been investigated, using protons from the Rice Institute Van de Graaff accelerator and a differentially pumped gas scattering chamber. Angular distributions and excitation curves at seven angles have allowed an explicit phase shift analysis of the data below 5 Mev. Only five nonzero phase shifts were necessary to fit the data to better than 10% at all energies and angles. The fourth and fifth excited states of N^{13} are identified at 4.808- and 5.37-Mev bombarding energy, and their respective assignments are $5/2^+$ and $3/2^+$, while their laboratory widths are 12 kev and 125 kev. The 4.43-Mev inelastic scattering γ radiation was studied by obtaining excitation curves and angular distributions which confirmed the $3/2^+$ assignment for the 5.37-Mev resonance. The large ratio of inelastic to elastic reduced widths for this level suggests that it and, possibly the fourth excited state of N^{13} are due to an S-wave proton configuration about C^{12} in its 2^+ first excited state. (auth)

610

RADIATIVE ORBITAL ELECTRON CAPTURE IN VANADIUM-49. R. W. Hayward and D. D. Hoppes (National Bureau of Standards, Washington, D. C.). Phys. Rev. 104, 183-5(1956) Oct. 1.

The x radiation and the continuous electromagnetic radiation accompanying orbital electron capture in V^{49} have been studied by means of an argon-methane proportional counter and a well-type sodium iodide scintillation spectrometer. The observed pulse-height distribution was corrected for background, energy resolution, escape of degraded radiation from the crystal, gamma-ray detection and geometrical efficiency of the crystal, and absorption of the radiation between the source and detector. The transition energy of the V^{49} decay is 616 ± 10 kev, giving a total disintegration energy of 621 ± 10 kev. The half life is measured as 327 ± 20 days, giving a log ft = 6.2, which is consistent with other allowed spectra with initial and final states in the $f_{7/2}$ shell. (auth)

611

INELASTIC NUCLEAR SCATTERING OF PHOTONS BY Au^{197}. Luise Meyer-Schutzmeister and V. L. Telegdi (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 104, 185-90(1956) Oct. 1.

A lower limit of the total inelastic nuclear photon scattering cross section of Au was determined as a function of energy by measuring the yield of the reaction $Au^{197}(\gamma,\gamma')Au^{197m}$ (7.5 sec) as a function of betatron energy. The use of pneumatic transfer and of NaI-counters in good geometry with 16-gram gold disks as samples enabled one to obtain good counting statistics and detailed decay curves at all betatron energies between 4 and 24 Mev. It is found that the cross section falls off steeply as soon as the competition from the (γ,n) reaction becomes possible. The maximum cross section of about 3.5 mb is reached at (7.8 ± 0.2) Mev. This disagrees with earlier work of Cameron and Katz but corresponds qualitatively to the same behavior as exhibited by $In^{115}(\gamma,\gamma')In^{115m}$ in the recent work of Burkhardt et al. Results indicate a second peak of the cross section at about 15 Mev, where the giant resonance has its maximum, in agreement with recent work of Hayward and Fuller on elastic scattering from gold. These results are compared with the predictions based on the statistical model. It is shown that they can be interpreted most naturally by assuming that below 12 Mev the width for γ emission is of the order of Weisskopf's estimate for Γ_{E2} or Γ_{M1}. Avail-

able experimental data on (γ,γ') reactions in other elements are reconsidered in the light of this conclusion. (auth)

612

INELASTIC SCATTERING OF 96-MEV PROTONS. K. Strauch and F. Titus (Harvard Univ., Cambridge, Mass.). Phys. Rev. 104, 191-8(1956) Oct. 1.

Using incident 96-Mev protons, the energy spectra of protons scattered into a laboratory angle of 40° have been obtained from the following elements: Li, Be, B, C, N, O, F, Na, Mg, Al, Si, P, S, Cu, Ag, Pb, and Bi. All targets had natural isotopic constitution. All spectra show an elastic peak and an inelastic continuum. Threshold considerations indicate that this continuum is often due to unresolved peaks at the very high-energy end. In addition, the spectra from the lighter elements show large inelastic peaks corresponding to the direct excitation of nuclear states in the target nucleus. Systematic trends are discussed. (auth)

613

ELASTIC AND INELASTIC SCATTERING OF 187-MEV ELECTRONS FROM CARBON-12. Jerome H. Fregeau (Stanford Univ., Calif.). Phys. Rev. 104, 225-36(1956) Oct. 1.

The scattering of 187-Mev electrons from C^{12}, reported previously, has been extended to 138°. It has been possible to separate the elastic scattering from the inelastic scattering and to resolve the inelastic groups from the 4.43-, 7.65-, and 9.61-Mev nuclear levels. "Absolute" values were obtained by comparing the scattering from carbon with the scattering from hydrogen and computing the proton cross section. The angular distribution of the elastically-scattered electrons falls off more steeply than the angular distribution of the inelastically-scattered electrons. Analysis of the data, using the Born approximation, shows that the root-mean-square radius of C^{12} (corrected for breakdown of the Born approximation) is $(2.37 \pm 0.05) \times 10^{-13}$ cm with a surface thickness of $(2.0 \pm 0.4) \times 10^{-13}$ cm. The corresponding value of r_0, the "classical" radius parameter, is $(1.33 \pm 0.02) \times 10^{-13}$ cm which is larger than that found from electron-scattering measurements for the heavy nuclei and is in agreement with the trend for light nuclei. The scattering from the 4.43-Mev and 7.65-Mev levels is larger than that predicted by some shell-model calculations. The transition from the ground state to the 9.61-Mev level appears to be either quadrupole or electric monopole, which gives a spin and parity assignment of either 2^+ or 0^+. (auth)

614

NUCLEAR QUADRUPOLE RESONANCE IN METALS. W. D. Knight, R. R. Hewitt, and M. Pomerantz (Univ. of California, Berkeley). Phys. Rev. 104, 271(1956) Oct. 1.

A search was made for the nuclear quadrupole resonance in those metals for which the size of the quadrupole interaction is large enough to prohibit observation of the nuclear magnetic resonance. Gallium was chosen for the initial searches which were made at 0°C. Strong lines were observed at 10.908 and 6.866 Mc/sec. (B.J.H.)

615

MAGNETIC ANALYSIS OF THE INELASTICALLY SCATTERED DEUTERONS AND DISINTEGRATION PROTONS FROM THE DEUTERON BOMBARDMENT OF FLUORINE. F. A. El Bedewi (Univ. of Liverpool, England). Proc. Phys. Soc. (London) A69, 221-33(1956) Mar. 1.

A magnetic spectrograph with photographic detection has been used to analyze the spectra of charged particles emitted from the bombardment of a thin teflon target by 8.9-Mev deuterons. Angular distribution measurements are also reported for several proton and deuteron groups produced in this bombardment. Two inelastically scattered deuteron groups corresponding to excited states in F^{19} at 1.60 ± 0.02 Mev and 2.83 ± 0.02 Mev have been observed. The angular distribution of the former group is compared with a theory proposed by Huby and Newns. A number of proton groups have been assigned to the $F^{19}(d,p)F^{20}$ reaction. Eight new excited states in F^{20} are observed at 5.04, 5.19, 5.27, 5.72, 5.87, 5.95, 6.25 and 6.52 Mev, with errors of ±0.02 Mev. The deuteron stripping theories have been applied to determine the l_n-values as well as the reduced widths of 21 excited states in F^{20}. The general behavior of the energy levels of this nucleus is discussed. The angular distribution of a proton group associated with the transition to the 6.091-Mev level in C^{14} is found to have $l_n = 0$. A possible configuration for this state is $(1p_{\frac{1}{2}})^1(2s_{\frac{1}{2}})^1$. (auth)

616

NUCLEAR SPINS AND MAGNETIC MOMENTS OF ^{161}Dy, ^{163}Dy, ^{171}Yb AND ^{173}Yb. A. H. Cooke and J. G. Park (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A69, 282-3(1956) Mar. 1.

Paramagnetic resonance absorption, in crystals of $Dy(C_2H_3O_2)_3$, $Yb(C_2H_3O_2)_3$, and in the same salts diluted with $Y(C_2H_3O_2)_3$, was observed. Working with the diluted salts at a wavelength of 3.1 cm and a temperature of 4.2°K the hyperfine structure due to the nuclear moments of the odd isotopes were observed, and nuclear spins were determined. (J.H.M.)

617

ATTENUATED ANGULAR CORRELATIONS BETWEEN K-CONVERSION ELECTRONS IN ^{197}Hg. E. Breitenberger (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A69, 566-73(1956) July 1.

The angular correlation between the successive K-conversion electrons from the de-excitation of 23-hr Hg^{197} has been investigated in an attempt to determine the limitations of correlation work with conversion electrons in cases of cascades with a long-lived intermediate state. Sources prepared by embedding the activity carrier-free in thin Al films exhibited consistent behavior; the second-order term of the correlation function was attenuated 18 ± 5% below the theoretical value. It is concluded that in cases of this type the necessity of using very thin sources, the limited choice of source backing materials, and the nuclear recoil accompanying the first conversion transition do not generally allow one to avoid all perturbative effects. An oxidized source exhibited complete 'loss of correlation memory.' An explanation of this phenomenon in terms of non-stationary hyperfine-structure interaction is proposed. If the highly charged ions left behind by the first conversion transition have a lifetime similar to that of the intermediate nuclear state, as can happen in a badly conducting course, the progressing neutralization affects the nuclear precession in a random way and thus leads to isotropy. (auth)

618

HYPERFINE STRUCTURE OF RADIOACTIVE SILVER $^{111}_{47}Ag$. G. K. Woodgate and R. W. Hellwarth (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A69, 581-7(1956) Aug. 1.

An atomic-beam apparatus is described with which the nuclear spin and hyperfine structure separation of the ground state of the radioactive isotope Ag^{111} have been found. (auth)

619

MASSES OF THE H, D, He^4, AND C^{12} ISOTOPES. R. A. Demirkhanov, T. I. Gutkin, V. V. Dorokhov, and A. D. Rudenko. Soviet J. Atomic Energy, No. 2, 163-9(1956).

Results are given of the measurements of the masses of the H, D, He^4 and C^{12} isotopes carried out by means of a mass spectrograph with a resolving power of 70,000 to

100,000. The data obtained agree well with the corresponding mass values obtained from the energy balance of nuclear reactions. (auth)

620

EXPERIMENTS ON THE CREATION OF EINSTEINIUM AND FERMIUM IN A CYCLOTRON. L. I. Guseva, K. V. Filippova, Yu. B. Gerlit, V. A. Druin, B. F. Myasoedov, and N. I. Tarantin. Soviet J. Atomic Energy, No. 2, 193-7 (1956).

The results are presented of some experiments on the creation of einsteinium and fermium by cyclotron irradiation of a uranium target with quintuply charged nitrogen ions (N V) and sextuply charged oxygen ions (O VI). The half lives and α-particle energies were measured with the aid of photographic plates, an ionization chamber with a spherical electrode, and a twenty-channel pulse-amplitude analyzer. The separation of transplutonic elements was performed by a chromatographic method. (auth)

621

MEASUREMENT OF THE AVERAGE NUMBER ν_{eff} OF NEUTRONS EMITTED PER SINGLE CAPTURE EVENT FOR SAMPLES OF Pu^{239} WITH IMPURITIES OF THE ISOTOPE Pu^{240} AND THE EFFECTIVE RESONANCE CAPTURE INTEGRAL OF Pu^{240}. B. G. Erozolimsky, I. E. Kutikov, Yu. P. Dobrynin, M. I. Pevzner, L. S. Danelian, and S. S. Moskalev. Soviet J. Atomic Energy, No. 3, 311-15(1956).

The results are presented of measurements of ν_{eff} in Fermi spectra with lower bounds of 0.15 ev (gadolinium filter) and 0.4 ev (cadmium filter) for samples of Pu^{239} with various concentrations of impurities of the isotope Pu^{240} (0%, 1.6%, 2.5%, 6.5%, 16%) and the effective resonance absorption integral of Pu^{240}. (auth)

622

THE RATIO OF THE AVERAGE FISSION CROSS SECTIONS OF Pu^{239} AND U^{235} IN URANIUM-WATER LATTICES. V. P. Katkov, Yu. V. Nikolsky, and G. A. Stoliarov. Soviet J. Atomic Energy, No. 3, 355-8(1956).

The ratio of the average fission cross sections of Pu^{239} and U^{235} is determined for lattices consisting of natural U and ordinary water. For comparison the same ratio was measured for a uranium-graphite reactor. It was found that the ratio $\bar{\sigma}_{Pu}^{f} / \bar{\sigma}_{U}^{f}$ for U-H_2O lattices with spacings of 45, 50, 55 and 60 mm and for a uranium-graphite reactor with 200 mm lattice spacing are 2.24, 1.99, 1.88 and 1.79, respectively. (auth)

623

A NEW SPLIT TECHNETIUM ISOTOPE Tc^{104}. J. Flegenheimer and W. Seelmann-Eggebert. Z. Naturforsch. 11a, 678(1956) Aug. (In German)

624

NUCLEON DISTRIBUTION IN HEAVY NUCLEI. C. H. von Kenschitzki and K. Wildermuth. Z. Naturforsch. 11a, 757-8(1956) Sept. (In German)

625

β-TRANSITION BETWEEN THE GROUND STATES OF RaB(Pb^{214}) AND RaC(Bi^{214}). H. Daniel. Z. Naturforsch. 11a, 759-60(1956) Sept. (In German)

626

NUCLEAR LEVELS IN THE NEIGHBOURHOOD OF THE $1F_{\frac{7}{2}}$ STATE. Rudolf Hans Nussbaum. Amsterdam, Van Corcum & Co. N.V., 1954. 78p.

A complete study was made of nuclear energy levels in the neighborhood of the $1F_{\frac{7}{2}}$ state. Included are discussions of the various nuclear models, a summary of the experimental techniques used, data on lower energy levels and decay properties in Sc^{45}, Sc^{43}, K^{43}, Cr^{49}, Cr^{51}, Ca^{47}, Sc^{47}, V^{47}, Fe^{53}, Sc^{49}, V^{49}, and a survey of nuclear levels in odd mass nuclides with N or Z between 16 and 32. (B.J.H.)

627

NUCLEAR SPECTROSCOPIC INVESTIGATIONS OF SOME ISOTOPES OF CAESIUM, LEAD, AND MERCURY. Gerard Johan Nijgh. Amsterdam, Drukkerij Wed. G. Van Soest, 1955. 86p.

A magnetic lens β spectrometer and a NaI(Tl) spectrometer were used to study nuclear level schemes. The disintegration schemes of Cs^{127} and Cs^{129} were determined, and the excited levels of the daughter nuclides, Xe^{127} and Xe^{129}, are compared with each other and with those of Xe^{131}. An investigation was also made of the decay properties of Pb^{202*}, Pb^{204*}, Pb^{203}, and Hg^{203}. (B.J.H.)

NUCLEAR REACTORS

628 AECU-3328

Internuclear Co., Clayton, Mo.

COOLING OF THE FOOD IRRADIATION REACTOR CORE. C. F. Leyse. July 6, 1956. 8p. A-1 Project. (IC-CFL-56-1). $1.80(ph OTS); $1.80(mf OTS).

Based on an assumed system pressure of 150 psi, a maximum reactor power of 20 Mw, and the results of calculations, reported herein, a core water velocity of 5 ft per sec was chosen as satisfactory for preliminary design considerations. With this core water velocity, the primary coolant system flow rate is about 2250 gpm. At 20 Mw reactor power, the maximum fuel plate surface temperature is about 325°F, and the bulk water inlet and outlet temperatures are about 137 and 198°F, respectively. (auth)

629 AECU-3329

Internuclear Co., Clayton, Mo.

HEATING AND COOLING OF THE INDIUM BLANKET, THERMAL SHIELD, AND SHIELDING POOL. C. F. Leyse. July 2, 1956. 8p. A-1 Project. (IC-CFL-56-2). $1.80(ph OTS); $1.80(mf OTS).

Preliminary estimations for a reactor power of 15 Mw give the heat generation in the blanket, thermal shield, and shielding pool as about 400 kw, 300 kw, and 75 kw, respectively. This heat is removed by taking 250 gpm of water from the shielding pool, passing it down annuli adjacent to the blanket tank and thermal shield, thence to a heat exchanger and back to the shielding pool. (auth)

630 AECU-3331

Internuclear Co., Clayton, Mo.

CONCERNING THE DIRECT USE OF CORE GAMMAS FOR FOOD IRRADIATION. W. R. Pearce. Apr. 24, 1956. 10p. A-1 Project. (IC-WRP-56-2). $1.80(ph OTS); $1.80(mf OTS).

For a permissible integrated fast neutron dose of 1.8×10^7 nvt, the maximum obtainable integrated γ dose is about 10^5 reps. This limiting ratio is independent of reactor power. It arises from the production of photoneutrons in the deuterium contained in water or in organic materials that are to be irradiated. The threshold for this reaction is 2.23 Mev and the cross section rises steeply with increasing photon energy, reaching a peak at about 4.5 Mev. Thus the photoneutron limitation would be of less importance for fission product gammas and would be absent for circulated activities emitting gammas below the energy threshold. (auth)

631 AECU-3341

Internuclear Co., Clayton, Mo.

PARAMETER STUDY OF A-1 REACTOR. Kenneth A. Hub. June 6, 1956. 12p. A-1 Project. (IC-KAH-56-8). $3.30(ph OTS); $2.40(mf OTS).

The system giving the lowest power occurred in the case of using a graphite reflector outside of blanket solution in

place of water. This power was 11.2 megawatts. In general the thin blankets, with approximately 0.6 cm space between tubes and 40/100 to 60/100 grams of sulfate per 100 grams of water, appeared as the best points of design. (auth)

632 AECU-3342
Internuclear Co., Clayton, Mo.
AN INVESTIGATION OF PRODUCTION RATE, DWELL TIME WITH COMMENTS ON DOSE. Kenneth A. Hub. June 5, 1956. 6p. A-1 Project. (IC-KAH-56-9). $1.80 (ph OTS); $1.80(mf OTS).

633 AECU-3371
General Electric Co. General Engineering Lab., Schenectady, N. Y.
ELECTRONIC ANALOG COMPUTER STUDY OF A NUCLEAR REACTOR STEAM PRESSURIZER. J. W. Bremer. Jan. 20, 1956. 69p. $12.30(ph OTS); $4.50 (mf OTS).

To prevent extreme pressure changes in reactor cooling systems due to reactor power demand surges, the installation of a steam pressurizer in the cooling system was recommended. In order to verify the applicability of small-scale experimental results to full-scale pressurizers, an analog computer study of pressurizer thermodynamics was conducted. The study is described and data predicting the characteristics of the proposed pressurizer are given. (D.E.B.)

634 AERE-C/M-281
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FEASIBILITY TESTS ON THE USE OF TOROIDS FOR DYNAMIC CORROSION TESTING IN-PILE. J. R. Cossey and R. Littlewood. June 5, 1956. 13p.

An experimental investigation to determine the optimum dimensions of a toroidal apparatus for circulating liquids in a 10-inch hole in DIDO is described. (auth)

635 AERE-R/R-1949
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
NEUTRON DISTRIBUTION IN THE AIR SPACED CORE ASSEMBLY OF ZEPHYR. J. E. R. Holmes, M. U. Curry, and M. Waldegrave. June 1956. 39p.

The nuclear reaction rate surveys which were made in the second core assembly of Zephyr are described. A detailed comparison with the first assembly leads to the following main conclusions: The core neutron spectrum in the air spaced core (Core II) has an average energy of about 1.7 Mev. This is more energetic than the core spectrum of the U spaced core (Core I), where the average energy is about 1.5 Mev. Using revised nuclear data, a neutron balance has been demonstrated for both assemblies. The breeding ratio for Core II is found to be 1.90 ± 0.15, which is slightly less than the Core I value of 2.00 ± 0.15. The observed delayed neutron fraction, β, is $0.34 \pm 0.01\%$ for the Core I assembly and $0.29 \pm 0.01\%$ for the Core II assembly. These values are appreciably greater than for Pu^{239} alone ($0.23 \pm 0.02\%$) and can be deduced from the fission rate surveys when the variation of neutron effectiveness with energy is taken into account. (auth)

636 ANL-5544
Argonne National Lab., Lemont, Ill.
EXPERIMENTAL BOILING WATER REACTOR (EBWR) SHIELD DESIGN. M. Grotenhuis and J. W. Butler. Aug. 1956. 42p. Contract W-31-109-eng-38. $0.30(OTS).

The EBWR shield and the methods used in its design are described. Shield adjustments necessary to make a change from H_2O to D_2O moderator are included. (auth)

637 CEPS-1134
[Commonwealth Edison Co., CEPS Group, Chicago].
GENERAL REACTOR COMPARISONS. A. WATER MODERATED AND COOLED. B. HEAVY WATER MODERATED AND COOLED. C. SODIUM COOLED. July 15, 1953. Decl. Oct. 22, 1956. 3p. $1.80(ph OTS); $1.80 (mf OTS).

A limited comparison of the advantages and disadvantages is made for various power production reactor types. The types considered are pressurized H_2O moderated and cooled, pressurized D_2O moderated and cooled, boiling D_2O moderated and cooled, D_2O homogeneous, thermal graphite moderated Na cooled, and fast Na cooled Pu breeder. (D.E.B.)

638 CF-49-11-176
Oak Ridge National Lab., Tenn.
ADDENDA MEMORANDUM TO THE MTR GRAPHITE REFLECTOR REPORT. F. C. Zapp. Nov. 17, 1949. Decl. June 13, 1956. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A proposed method of discharging graphite pebbles from the MTR is shown. The system consists of an 8-in. discharge tube inclined at a 20° angle to the horizontal and dropping vertically to a discharge cubicle. Two slide valves and a retention bin are in the vertical leg of the discharge line.) (F.S.)

639 CF-49-11-208
[Oak Ridge National Lab., Tenn.]
MTR REPORT ON INTERNAL AIR SYSTEM. W. R. Gall. Nov. 21, 1949. Decl. Sept. 13, 1956. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The design of passages for graphite cooling air through the MTR shield is outlined. (F.S.)

640 CF-50-1-30
[Oak Ridge National Lab., Tenn.]
GRAPHITE FOR THE MATERIALS TESTING REACTOR. F. C. Zapp. Jan. 10, 1950. Decl. Sept. 13, 1956. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

641 CF-51-3-68
[Oak Ridge National Lab., Tenn.]
MTR DESIGN REPORT — CONTROLS. R. E. Engberg. Mar. 31, 1951. Decl. Sept. 13, 1956. 32p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The design and specifications for the MTR control system which would provide a combination of manual operation by an operator and automatic control with instruments and signals, are given. (F.S.)

642 CF-54-12-206
Oak Ridge National Lab., Tenn.
THE HRT AND THE "WALK-AWAY" PHENOMENON. M. Tobias. Dec. 28, 1954. Decl. Oct. 10, 1956. 25p. Contract [W-7405-eng-26]. $0.35(OTS).

The "walk-away" phenomenon is examined, and means of avoiding it are discussed. (L.M.T.)

643 CF-55-3-60
Oak Ridge National Lab., Tenn.
FURTHER STUDIES OF THE "WALK-AWAY" PHENOMENON FOR THE HRT. Melvin Tobias. Mar. 2, 1955. Decl. Oct. 10, 1956. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The "walk-away phenomenon" can be prevented by employing automatic controls in the heat removal system. However, a simpler remedy is the proper choice of inherent reactor variables (e.g. fuel pump feed rate and overpressure). The effects of some of these variables on reactor stability is discussed. (F.S.)

644 CF-55-5-103(Rev. 1)
Oak Ridge National Lab., Tenn.
A BIBLIOGRAPHIC FILE OF TECHNICAL REPORT ABSTRACTS USEFUL TO REACTOR CONTROL SYSTEM ENGINEERING. Francis P. Green. Oct. 1, 1956. 17p. Contract [W-7405-eng-26]. $0.20(OTS).

To make information regarding all aspects of reactor control system engineering readily available to technical personnel a punched-card abstract file of all pertinent classified and declassified technical reports was made. The indexes to the subject code are compiled in categorical and alphabetical forms to permit two approaches to finding the code number. An index is also supplied to indicate the source of publication code. (F.S.)

645 CF-55-5-163
Oak Ridge National Lab., Tenn.
STABILITY OF HOMOGENEOUS REACTORS. Paul R. Kasten. May 25, 1955. Decl. Jan. 25, 1956. 22p. Contract [W-7405-Eng-26]. $4.80(ph OTS); $2.70(mf OTS).

A comparison between one- and two-region reactors is given with regard to their stability. There appears to be no distinct advantage of one type over the other, since the stability criteria changes with operating conditions and nuclear parameters in a manner which leads to about the same stability for each reactor type. (auth)

646 CF-55-8-77
Oak Ridge National Lab., Tenn.
RADIOLYTIC GAS GENERATION RATES IN THE HRT. R. E. Aven and P. N. Haubenreich. Aug. 31, 1955. Decl. Sept. 20, 1956. 28p. Contract [W-7405-eng-26]. $4.80 (ph OTS); $2.70(mf OTS).

Estimates were made of the gas production rates in the core circulating system, reflector circulating system, core pressurizer, fuel dump tanks, and thermal shield, when the HRT was operating at 10 Mw with a D_2O reflector. (W.L.H.)

647 CF-55-8-189
Oak Ridge School of Reactor Technology, Tenn.
MULTIGROUP-MULTIREGION THEORY FOR THE CONSISTENT P_1 APPROXIMATION TO THE BOLTZMANN EQUATION. B. John Garrick. Aug. 1955. 50p. $7.80(ph OTS); $3.30(mf OTS).

The consistent P_1 integral equations in lethargy and space, together with the coupling equations expressing the slowing down of neutrons, are reduced to a set of partial differential equations describing the P_1 approximation. The group equations are integrated over lethargy by assuming flux linearity over a lethargy interval. Consideration is given to the thermal motion of the moderator atoms in developing the thermal group equations and their distribution of velocity is assumed Maxwellian as it is for the neutrons. The spatial integration is performed by approximating the differential equation by a difference equation and integrating utilizing a technique previously developed. (auth)

648 DP-48
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
REACTIVITY MEASUREMENTS IN A SUBCRITICAL PILE. R. C. Axtmann, G. Dessauer, and T. F. Parkinson. Nov. 1955. 20p. Contract AT(07-2)-1.

Experiments showed that there exists in a subcritical pile of low critical mass a range of multiplications that are high enough for precision testing of pile components and yet low enough for the rapid establishment of equilibrium in each test. Advantages of subcritical testing over the conventional "danger coefficient" method are discussed. (auth)

649 HW-39668
Hanford Atomic Products Operation, Richland, Wash.
PHYSICAL CONSTANTS TESTING REACTOR—MECHANICAL COMPONENTS. W. J. Morris. Nov. 30, 1955. Decl. Mar. 26, 1956. 79p. Contract W-31-109-Eng-52. $0.55 (OTS).

The Physical Constants Testing Reactor is a small enriched U graphite reactor with a sizable cavity at its center. The reactor will be used to determine buckling, conversion ratio, temperature coefficients of reactivity, resonance escape probability, thermal utilization, and the number of fast neutrons produced per thermal neutron absorbed in the metal of the lattice that is undergoing investigation in the test cavity by means of critical experiments. Criticality is achieved by filling the cavity with a typical section of lattice whose physics parameters are known. Then a section of the lattice to be tested is placed in the test cavity and the reactor is brought to critical. The differences in the two critical settings is interpreted in terms of the properties of the test lattice. The PCTR is a versatile reactor featuring several new and unique mechanical components. The specifications and particulars of the various mechanical components are described with testing procedures and results. (auth)

650 IDO-16309
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
INSTABILITY IN THE SPERT-I REACTOR. Preliminary Report. S. G. Forbes, F. Schroeder, and W. E. Nyer. Oct. 10, 1956. 19p. Contract AT(10-1)-205. $0.20(OTS).

Severe instability has been observed in the SPERT-I Reactor. This instability was manifested by a series of power pulses of such rapidly increasing amplitude that the safety of the reactor was jeopardized. The preliminary investigation of this instability is described with discussion limited to an account of the actual observations since confirming experiments were lacking at the time of publication. Plots of power and temperature behavior are included for five tests of this type. (auth)

651 IDO-24020
General Electric Co. [Atomic Power Equipment Dept., Schenectady, N. Y.] and Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif.
ENGINEERING TEST REACTOR ENGINEERING DESIGN AND SAFEGUARDS REPORT. July 1956. 347p. Contract AT(10-1)-770. (GEAP-0554; KE-56-19-R). $1.75(OTS).

The Engineering Test Reactor (ETR) is designed to perform engineering tests on fuel elements and components of nuclear plants. Its main purpose is to provide large experimental facilities with very high neutron fluxes, thus supplementing research reactors already in use. The reactor complex is described in detail and engineering drawings are given for the complete system, including buildings and services. Various operational considerations are evaluated from a reactor safeguards basis. (auth)

652 NP-6115
Babcock and Wilcox Co., New York.
ECONOMICS OF THORIUM AND NATURAL URANIUM IN POWER REACTORS. Donald Kallman. [1956?]. 13p.

The required fuel and breeder material investments are significant factors in the economics of nuclear power production. The nuclear properties of U^{233}, U^{235}, Pu^{239}, U^{238}, and Th^{232} are reviewed in an attempt to establish the best economic arrangement of fuel and blanket. The U^{233}–Th^{232} arrangement is expected to yield the greater economic advantages. (D.E.B.)

653 ORNL-2164
Oak Ridge National Lab., Tenn.
A FLUX DEPRESSION EXPERIMENT IN THE MTR. J. B.

Trice. Oct. 24, 1956. 38p. Contract W-7405-eng-26. $0.30(OTS).

Thermal-neutron flux intensities were measured in the interior of several solid, cylindrical rods inserted into an MTR beam hole. Variables that were studied included both the functional dependence of cross section on neutron energy and the extent of absorption—"greyness" of neutron absorber. It was found that the first variable has only a small effect on flux depression in the rod. The second variable, "greyness," has a large effect, and for this reason, a graphical relation between absorber "greyness" and thermal-flux reduction was established. (auth)

654 WAPD-FE-96

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

APPLICATION OF FORCED CONVECTION HEAT TRANSFER AND FRICTION CORRELATIONS IN CORE DESIGNS. J. D. Roarty. July 6, 1954. Changed from OFFICIAL USE ONLY Aug. 28, 1956. 6p. $1.80(ph OTS); $1.80(mf OTS).

655 WAPD-P-652

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

ENERGY FROM FISSION PRODUCT DECAY. F. E. Obenshain and A. Foderaro. May 1955. Changed from OFFICIAL USE ONLY July 6, 1956. 15p. $3.30(ph OTS); $2.40(mf OTS).

The latest data and equations describing the rate of energy release from fission products after a period T_o of constant fissioning are compiled. The decay curve Γ (t) has been fit in two ways: a piece-wise continuous curve, and a continuous curve which is the sum of exponentials. (auth)

656 WAPD-TN-515

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

RADIOACTIVE SOURCES IN REACTOR PRIMARY COOLANTS. A. H. Foderaro and M. A. Robkin. June 1955. Decl. Oct. 17, 1956. 35p. Contract AT-11-1-GEN-14. $0.40(OTS).

Two sources of activity in reactor primary coolants are acknowledged, that due to the nuclear constitution of the coolant and that due to corrosion products in the coolant. An attempt is made to develop a semi-analytic theory to predict the specific activity of a reactor's primary coolant based on transport parameters which must be determined a priori. The results of the theoretical calculation in the case of the corrosion product activity are compared to the exact solution which was obtained on an analogue computer based on these transport parameters. The agreement between the theoretical and analogue solutions is found to be good. The results of the computation are graphed for comparison with the analogue solution, as well as nomograms to aid in computing the activity due to activating the nuclei of the coolant. Derivations are included in the appendices. (auth)

657 IGRL-T/R-15

PROCESS FOR THE EXECUTION OF NUCLEAR FISSION. J. J. Went. Translated by J. E. Gregory from German Federal Republic Patent Application: Class 21g. Group 21/10. St. 8296 8c/21g. June 11, 1954. 7p.

A method for separating fission products from a homogeneous reactor fuel suspension by passing the suspension through one or more hydroclones is described. This method requires that the suspension particle range be within 0.01 and 15 μ, having a mean effective diameter of 1 μ. (D.E.B.)

658

CALDER HALL—MECHANICAL ENGINEERING ASPECTS. Atomics 7, 354-65(1956) Oct.

659

BATCH VERSUS CONTINUOUS PROCESSING. C. E. Dryden and J. M. Frame (General Electric Co., Schenectady, N. Y.). Chem. Eng. Progr. 52, 371-4(1956) Sept.

Batch vs. continuous methods of fuel processing for a nuclear reactor are compared for the purpose of developing a criterion for selection of the method for lowest power cost. (T.R.H.)

660

FUNDAMENTAL IDEAS RELATIVE TO NUCLEAR REACTORS. M. Surdin (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 791-817 (1955) Oct. (In French)

The fundamentals of reactor theory are surveyed, including discussions on radioactivity, nuclear reactions, nuclear fission, and reactor kinetics. (B.J.H.)

661

MATERIALS TESTING BY THE OSCILLATION METHOD IN THE CHATILLON PILE. D. Breton (Département des Etudes de Piles, Fort de Châtillon, France). L'Onde Électrique 35, 837-46(1955) Oct. (In French)

Descriptions are given of the oscillation method for evaluating potential reactor materials. (B.J.H.)

662

AN ANALOG HARMONIC ANALYZER. J. Pottier (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 847-66(1955) Oct. (In French)

A theoretical analysis and design are given for a harmonic analog analyzer intended for the determination of impurities in reactor graphite. (B.J.H.)

663

RECENT PROGRESS IN THE CONTROL OF REACTORS. Jacky Weill (Centre d'Etudes Nucleaires de Saclay, France). L'Onde Electrique 35, 867-87(1956) Oct. (In French)

The instruments used to measure reactor power are described in some detail, including ionization chambers, neutron detectors, and continuous current amplifiers. Systems for the complete automation of the control of nuclear reactors are also described. (B.J.H.)

664

ANALOG COMPUTERS, REACTOR SIMULATORS. P. Braffort (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Electrique 35, 888-98(1955) Oct. (In French)

The fundamentals of analog computers as reactor simulators are reviewed, and their development is discussed. (B.J.H.)

665

CALDER HALL—THE FIRST NUCLEAR POWER STATION IN THE WORLD—HOW IT WAS BUILT—HOW IT WORKS. Nuclear Power 1, 240-58(1956) Oct.

The Calder Hall power station, consisting of two natural U, Pu producing graphite moderated, gas cooled reactors in steel pressure vessels four turbo alternator turbines, two dump condensers for absorption of reactor heat output when the turbines are out or on part load, and two hyperbolic cooling towers, is described. (F.S.)

666

THE SAFETY OF REACTOR CONTROL SCHEMES. J. Walker (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 263-5(1956) Oct.

The safety system of a nuclear reactor must be designed so that the maximum possible reactivity conceivable under any combination of fault conditions can be removed and the reactor brought sub-critical before any catastrophic situation is reached. This is generally achieved by the primary shut-off system backed by a secondary or safety system. The importance of power measurement down to the lowest levels is emphasized and factors affecting the design and

location of ionization chambers and neutron counters are considered. (auth)

667

HEAT RECOVERY FROM REACTORS. P. Chambadal and J. P. Roux. Nuclear Power 1, 266-9(1956) Oct.

Possible ways of raising steam at the French power reactors at Marcoule are described. (F.S.)

668

CANADIAN EXPERIMENTS AIM AT ECONOMIC NUCLEAR POWER. W. B. Lewis (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nucleonics 14, No. 10, 28-31(1956) Oct.

Results from the recent NRX experiments show that atomic power in a limited form may come into economic competition with coal as applied to steam-driven electrical generating plants. (W.L.H.)

669

FABRICATING THE HRT CORE. W. R. Gall (Oak Ridge National Lab., Tenn.). Nucleonics 14, No. 10, 32-3(1956) Oct.

Techniques have been developed for rolling, forming, forging, welding and heat treating the zircaloy-2 core vessel used in the Homogeneous Reactor Test. (W.L.H.)

670

HOW STRONG MUST REACTOR HOUSINGS BE TO CONTAIN Na–AIR REACTIONS? Edward Hines, Andrew Gemant, and J. K. Lelley (Detroit Edison Co., Detroit, Mich.). Nucleonics 14, No. 10, 38-41(1956) Oct.

Experiments and calculations point to 40 psig as highest pressure to expect for closed-system Na–air reactions, regardless of the amount of Na or size of the reactor housing. Maximum gas-phase temperature would be about 1000° C. (auth)

671

REACTOR FACILITY TO PROVIDE LARGE VOLUME FOR IRRADIATION TESTS. Paul J. Sykes (Wright Air Development Center, Wright-Patterson Air Force Base, Ohio). Nucleonics 14, No. 10, 42-5(1956) Oct.

Experimental facilities of the Air Force Reactor will include fast-neutron irradiation cells, bulk shielding pool, thermal column, beam tubes, and spent-fuel gamma irradiation equipment. Extensive hot cells and laboratories are planned. (auth)

672

UNDERWATER LIGHTS FOR A POOL-TYPE RESEARCH REACTOR. C. J. R. Witman, R. G. Cochran (Pennsylvania State Univ., University Park) and R. D. Rung (Curtiss-Wright Corp., Quehanna, Penna.). Nucleonics 14, No. 10, 84-5(1956) Oct.

In a swimming-pool type research reactor it is essential to have adequate lighting on the core to facilitate loading and unloading fuel elements, reflectors, instruments, and other experimental equipment. A simple light unit that omits these requirements has been designed and constructed. Construction details are shown. (W.L.H.)

673

LEAKPROOF VALVES FOR WATER-COOLED REACTORS. John P. Thorel (Westinghouse Atomic Equipment Dept., Pittsburgh). Nucleonics 14, No. 10, 96-8(1956) Oct.

The design of several leakproof valves for water-cooled reactors is presented. Corrosion problems are considered. (W.L.H.)

674

SMALL 5-WATT REACTOR IS FOR TEACHING, RESEARCH. Nucleonics 14, No. 10, 98 & 100(1956) Oct.

A 5-watt research reactor offers a thermal-neutron flux of 10^8 n/cm^2/sec. The fuel is enriched UO_2SO_4 solution and its critical mass is 1,000 to 1,500 g of U^{235}. (W.L.H.)

675

FAST-NEUTRON DAMAGING IN NUCLEAR REACTORS: ITS KINETICS AND THE CARBON ATOM DISPLACEMENT RATE. William Primak (Argonne National Lab., Lemont, Ill.). Phys. Rev. 103, 1681-92(1956) Sept. 15.

It is shown that the radiation damage produced in graphite at near room temperature is labile. A theory describing this lability is developed. Then using this theory and an identification and determination of the portion of the neutron flux spectrum responsible for the damage as obtained in another paper, the displacement rates for the condition that no annealing had intervened are calculated from the number of displacements which had been determined in graphite samples which had been irradiated near room temperature. From several different methods there is obtained, within a factor of 2, the following result: 10^{-21} displacements atom per damaging neutron/cm^2 for the number of displacements which remain after a scattering event involving a fast neutron near the beginning of the irradiation under conditions in which thermal annealing is not occurring. (auth)

676

THE STUDY OF THE PHYSICAL CHARACTERISTICS OF THE REACTOR OF THE ATOMIC ELECTRIC POWER STATION. A. K. Krasin, B. G. Dubovsky, E. Ya. Doilnitsyn, L. A. Matalin, E. I. Inyutin, A. V. Kamaev, and M. N. Lantsov. Soviet J. Atomic Energy, No. 2, 139-47 (1956).

A description is given of experiments on the study of physical characteristics of the reactor of the atomic electric power station of the Academy of Sciences of the USSR. The data obtained may be utilized both in connection with the starting up and operation of other similar reactors, and also in the further improvement of the methods of engineering design calculations for the heterogeneous energy-producing water-cooled reactors operating on thermal neutrons. (auth)

677

MULTIGROUP METHOD OF CALCULATIONS USED IN THE DESIGN OF THE REACTOR FCR THE ATOMIC ELECTRIC POWER STATION. G. I. Marchuk. Soviet J. Atomic Energy, No. 2, 149-61(1956).

In a previous work a survey is given of the methods and of the results of the physical design calculations for the reactor of the APS which are closely related to the well known two-group method. The design calculations for the APS reactor were also performed by means of the multigroup method. Some of the results of the calculations obtained on the basis of an extensive use of the method of finite differences are given in the present article. (auth)

678

RELATIVE Pu^{239} BREEDING RATIO IN NATURAL URANIUM–ORDINARY WATER LATTICES. L. V. Komissarov and V. A. Tarabanko. Soviet J. Atomic Energy, No. 3, 349-53(1956).

Measurements were performed of the quotient of breeding ratios in uranium-water lattices and a uranium–graphite lattice at the start of conversion. The plutonium breeding ratio in uranium–water lattices for certain lattice spacings is larger than in a uranium–graphite lattice. (auth)

679

WORKING-STRESS CRITERIA FOR NUCLEAR POWER PLANTS. B. F. Langer (Westinghouse Electric Corp., Pittsburgh). Trans. Am. Soc. Mech. Engrs. 78, 661-5(1956) July.

A method is proposed for combining the stresses produced by fluid pressure with those produced by thermal gradients in order to arrive at a practical estimate of the factor of safety in a structure such as a pressure vessel.

Because of the relaxation of thermal stress it is possible to show that certain operating conditions are really safe even though a simple addition of pressure stress and thermal stress gives too high a value. The relative importance in reactor design of such physical properties as ductility, creep, endurance limit, creep-rupture strength, impact strength, and notch sensitivity is discussed. (F.S.)

680

FABRICATION OF THE HOMOGENEOUS REACTOR TEST VESSEL ASSEMBLY. L. F. Bledsoe and F. V. Daly (Newport News Shipbuilding & Drydock Co., Va.; G. E. Elder (Electro-Mechanical Labs., White Sands Proving Ground, N. Mex.; and W. R. Gall and E. C. Miller (Oak Ridge National Lab., Tenn.). Welding J. (N. Y.) 35, 997-1006(1956) Oct.

The problems of the fabrication of the HRT vessel include those which are of a special nature occasioned by the unusual requirements of design and application. The selection of materials of construction of the pressure vessel, the fabrication of the heads and nozzles and flanged end connections to the pressure vessel, the development of the closing joint weld for joining the hemispherical halves, fabrication of blast shield, and the Zircaloy-2 core tank are described. (J.E.D.)

681

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 3. POWER REACTORS. New York, United Nations, 1955. 389p. $7.50.

682

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 5. PHYSICS OF REACTOR DESIGN. New York, United Nations, 1956. 545p. $9.00.

683

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, AUGUST 8-20, 1955. VOLUME 9. REACTOR TECHNOLOGY AND CHEMICAL PROCESSING. New York, United Nations, 1956. 771p. $10.00.

Refer to abstract 13.

NUCLEAR TRANSFORMATION

684 AEC-tr-2646

AN ISOMER OF RHODIUM-106. G. B. Baro, W. Seelmann-Eggebert, and I. Zabala. Translated by George Watson from Publ. com. nacl. energia atomica (Buenos Aires), Ser. quim. 1, 29-41(1955). 9p.

Isotopes with an excess of neutrons, formed by the actions of deuterons on Pd and of neutrons on Ag, were studied. The activities of Rh with periods of 23, and 117 minutes and 36.5 hr were investigated. A 117-minute period corresponds to an isomer of Rh^{106} of 30 sec with a greater Q value and is Ru^{106}. The probability of an isomeric transition from Rh^{106} to Ru^{106} is less than 1%, since β rays with energy corresponding to Rh^{106} were not detected. (F.S.)

685

APPLICATION OF THE THEORY OF STOCHASTIC PROCESSES TO THE INVESTIGATION OF NUCLEAR FISSION. L. Pal. Soviet Phys. JETP 3, 264-8(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 367-73(1956) Feb. (In Russian).

The statistical theory of the ionization chamber is considered for the investigation of nuclear fission. The mean number of pulses produced by the α particle background is determined. A theory of random processes is developed in connection with the investigation of this stochastic process. (auth)

686

THE PHOTODISINTEGRATION OF OXYGEN NUCLEI INTO FOUR ALPHA-PARTICLES. W. K. Dawson and D. L. Livesey (Queen's Univ., Kingston, Ont., Canada). Can. J. Phys. 34, 241-9(1956) Mar.

A total of 323 four-prong stars found in photographic plates exposed to bremsstrahlung of maximum energy 70 Mev have been identified as due to the disintegration of O^{16} nuclei into four alpha-particles. The excitation function of the reaction exhibits pronounced peaks at 22.5 and 32.5 Mev as well as maxima at intermediate energies, and the integrated cross sections for various energy ranges have been estimated. The mechanism of the process has been investigated and most of the disintegrations proceed via known excited levels in C^{12} and various states of Be^8. (auth)

687

EVAPORATION NEUTRONS FROM COSMIC RAY NUCLEAR INTERACTIONS IN VARIOUS ELEMENTS. K. W. Geiger (National Research Council, Ottawa, Canada). Can. J. Phys. 34, 288-303(1956) Mar.

Production of evaporation neutrons from nuclear interactions by cosmic rays is investigated in C, Al, Fe, Cu, Pb, and Bi. Boron trifluoride counters in a paraffin moderator in which the element under study is placed serve to detect the evaporation neutrons. A cosmic ray telescope allows the consideration of ionizing neutron-producing particles separately and it is found that of the total neutrons 14.6% are produced by ionizing particles. The mean neutron multiplicities are worked out and they show an increase with the two-thirds power of the atomic weight of the element in which the interactions take place. Also, the rate of interactions is calculated and this gives the relative interaction cross-sections which are found to increase slightly more with atomic weight than expected if the cross-section is geometric. An estimate of the intensity of the N-component is made and discussed in connection with measurements published by other authors. (auth)

688

CROSS SECTIONS OF (p,xn) REACTIONS IN THE ISOTOPES OF LEAD AND BISMUTH. R. E. Bell and H. M. Skarsgard (McGill Univ., Montreal, Canada). Can. J. Phys. 34, 745-66(1956) Aug.

Measurements have been made by the activation method of cross sections of (p, xn) reactions in Bi^{209}, Pb^{206}, Pb^{207}, and Pb^{208}. The present results cover x = 3 to 7 in Bi^{209}, 2 to 6 in Pb^{206}, 2 to 4 in Pb^{207}, and 3 and 4 in Pb^{208}, over a total proton energy range from 12 to 85 Mev. The absolute accuracy is about 15%. Each cross section plotted as a function of proton energy rises above its threshold to a peak whose height is of the order of one barn, and then falls again to a low and fairly constant value. The results from x = 3 to 7 are consistent with a compound nucleus plus prompt nucleon–nucleon cascade model using reasonable nuclear parameters, but the experimental (p, 2n) cross section appears to be almost double the value so predicted. Since (p, xn) reactions are dominant in the energy range 10 to 40 Mev., their sum approximates the total reaction cross section; the experimental sum fluctuates around the smooth curve computed for the compound nucleus model with $r_0 = 1.3 \times 10^{-13}$ cm. The fluctuations are similar to, but more marked than, those in the total neutron cross section of heavy elements in the same energy range. (auth)

689

A SCHEMATIC MODEL FOR (p,xn) CROSS SECTIONS IN HEAVY ELEMENTS. J. D. Jackson (McGill Univ., Montreal, Canada). Can. J. Phys. 34, 767-9(1956) Aug.

A schematic model for the description of (p, xn) reactions in heavy elements is presented. Reactions are divided into two steps, a prompt multiple collision process, followed by an evaporation stage. The various prompt processes are given by the results of Monte Carlo calculations, while the evaporation processes are described by a simplified model assuming constant nuclear temperatures and only neutron evaporation. The resulting (p, xn), and to a minor degree (p, pxn), cross sections are compared with the experimental data of Bell and Skarsgard [Can. J. Phys. 34, 745(1956)] in the energy range up to 100 Mev. With an average neutron binding energy of around 7.3 Mev, a nuclear temperature of about 1.8 Mev, and a nuclear radius of 8.0×10^{-13} cm, a reasonable over-all fit can be made to the data for Pb^{206}, Pb^{207}, Pb^{208}, and Bi^{209}. Characteristic fluctuations in the experimental results for the (p, 2n), (p, 3n), and (p, 4n) reactions for all targets seem to be attributable to variations in the total reaction cross section, and are not reproduced by the present model. (auth)

690

THE PHOTOPROTONS EMITTED FROM OXYGEN-16 NUCLEI. D. L. Livesey (Queen's Univ., Kingston, Ont., Canada). Can. J. Phys. 34, 1022-32(1956) Oct.

The photographic plate method has been used to study photoprotons emitted from oxygen gas exposed to bremsstrahlung of maximum energies 30, 35, and 70 Mev. The proton energy distributions above 5 Mev show maxima corresponding to peaks in the (γ,p) excitation function at 20.7, 21.9, and 24.0 Mev. The proton angular distributions are anisotropic, in general agreement with a $\sin^2\theta$ function, but the high-energy protons exhibit a degree of asymmetry about the 90° angle which may be due to a small electric-quadrupole interference effect. (auth)

691

DETERMINATION OF THE EXCITATION FUNCTION OF $_{12}Mb(\alpha,n)_{14}Si$ NUCLEAR PROCESSES. J. Nagy. Acta Phys. Acad. Hung. 3, No. 1, 15-22(1953).

A half-spherical Mg metal surface is bombarded with the α rays of a Po preparation placed in the center of the half sphere. The excitation curves of the resulting $Mg(\alpha,n)S$ nuclear processes are measured by a BCl_3-filled ionization chamber. By measuring the counting rate of the chamber it is also possible to obtain the absolute yield of the nuclear transformation. The neutron radiation is likely to be emitted by the Mg^{25} isotope. (auth)

692

INVESTIGATION OF COULOMB EXCITATION OF NUCLEI BY NITROGEN IONS. D. G. Alkhazov, D. S. Andreyev, A. P. Greenberg, and I. Kh. Lemberg (Leningrad Physico-Technical Inst., U.S.S.R.). Nuclear Phys. 2, 65-80(1956) Sept.

The ratio of the cross sections for Coulomb nuclear excitation by heavy particles and protons has been computed. It is shown that in many cases it is more profitable to use heavy ions than protons for Coulomb excitation of nuclei. Preliminary results of a study of Coulomb excitation of a number of nucleides with 15.6-Mev nitrogen ions are presented. (auth)

693

THE FORMATION OF He^5 BY THE DEUTERON BOMBARDMENT OF Li^7. A. C. Riviere (Australian National Univ., Canberra). Nuclear Phys. 2, 81-90(1956) Sept.

The reaction $Li^7(d,\alpha)He^5$ (n) He^4 has been studied at a deuteron energy of 900 kev by observing coincidences between alpha-particles concurrent with a measurement of their energies. The results are compared under certain assumptions and are consistent with the properties of He^5 as given by the scattering of neutrons in He^4. It is estimated that less than one tenth of the disintegrations observed are due to the alternative reactions $Li^7(d,n)$ $Be^8(\alpha)$ He^4 and $Li^7(d,n\alpha)He^4$. (auth)

694

DISINTEGRATIONS OF LIGHT NUCLEI IN NUCLEAR EMULSIONS BY SLOW π^- MESONS. M. Demeur, A. Huleux, and G. Vanderhaeghe (Centre de Physique Nucleaire de l'Universite Libre de Bruxelles). Nuovo cimento (10) 4, 509-25(1956) Sept. (In French)

Ilford G-5 plates were exposed to slow π^- mesons produced by the Rochester Cyclotron. About 1500 σ stars were classified according to the number of prongs and according to whether they were produced in a light nucleus (C, N, O) or a heavy nucleus (Br, Ag) of the emulsion. The examination of stars produced in the light nuclei has allowed investigation of the modes of disintegration of these nuclei. An extension of the scheme of Clark and Ruddlesden is proposed which gives an account of about $^2/_3$ of the observed stars. The remaining stars contain at lease one fragment ($Z > 2$) and seem better interpreted by a mechanism of local heating. (auth)

695

MEASUREMENT OF THE ENERGY SPECTRUM OF PROTONS FROM (n,p) REACTIONS ON Mg AND Zn WITH 14 KEV NEUTRONS. L. Colli and U. Facchini (CISE, Milan). Nuovo cimento (10) 4, 671-3(1956) Sept.

A proportional counter and a scintillating crystal were used to study the protons from (n,p) reactions in Mg and Zn, and preliminary results are given. (B.J.H.)

696

ON THE NATURE OF PARTICLES PRODUCED IN EXTREMELY ENERGETIC NUCLEAR COLLISIONS. F. A. Brisbout, C. Dahanayake, A. Engler, Y. Fujimoto, and D. H. Perkins (Univ. of Bristol, England). Phil. Mag. (8) 1, 605-21(1956) July.

A detailed investigation into nuclear collisions of energy between 10^{12} to 10^{13} ev is reported. The ratio of π^0 mesons to charged shower particles has been determined with high statistical accuracy yielding a value $R = 0.383 + 0.044$. The central cores of the 'jets' have been carefully scanned to detect secondary interactions produced by the shower particles and the ratio, Q, of the number of interactions produced by neutral to the number produced by charged shower particles has been obtained. $Q = 0.25 + 0.09$. If it is assumed that in nuclear collisions of very high energy, neutral and charged particles (other than π mesons) are created in approximately equal numbers and that the interaction mean free path for such particles does not differ appreciably from that of π mesons, the values R and Q enable an estimate to be made of the fraction of shower particles which are not π mesons. The results indicate that ~25% of the shower particles must be heavy mesons, hyperons, nucleon–antinucleon pairs, and ejected nucleons. In order to estimate the contribution to the above fraction from heavy mesons, a detailed analysis of the products of secondary disintegrations has been carried out. The results, although preliminary, are compared with those of Dahanayake et al. (1955) and are consistent with the assumption that most of these unidentified shower particles in the core are heavy unstable particles. The lifetime of the π^0 meson has been determined by a method which does not involve the determination of the energy of the meson. The mean life obtained is $1.8^{+2.2}_{-1.1} \times 10^{-15}$ sec. (auth)

697

ANGULAR DISTRIBUTION OF PHOTONEUTRONS FROM CARBON AND BERYLLIUM. B. P. Fabricand, B. A. Allison, and J. Halpern (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 103, 1755-7(1956) Sept. 15.

The photoneutron angular distributions from C and Be have been measured by using bremsstrahlung of maximum

energies of 23 Mev and 18 Mev, respectively. The results are $1 + (1.35 \pm 0.88) \sin^2\theta$ for C and $(1.26 \pm 0.11) + \sin^2\theta$ for Be. (auth)

698

STUDY OF THE REACTION $Li^6(d,n\gamma)Be^7$. G. C. Neilson and J. B. Warren (Univ. of British Columbia, Vancouver, Canada). Phys. Rev. 103, 1758-63(1956) Sept. 15.

The angular correlation of the neutrons to the first excited state in Be^7 and the associated 430-kev gamma rays has been measured. Energy selection of the neutrons was made possible by a time-of-flight spectrometer. The angular correlations were predominantly isotropic at bombarding energies below 600 kev, while above this energy the correlations showed a strong peaking in the beam direction. Analysis using stripping theory shows that the 430-kev state is very probably a $J = \frac{1}{2}-$ state. The excitation function corrected for Coulomb penetration shows a resonance corresponding to an excited state in Be^8 at 22.6 Mev. (auth)

699

Q VALUE FOR THE $Cu^{65}(p,n)Zn^{65}$ REACTION. J. B. Marion and R. W. Kavanagh (California Inst. of Tech., Pasadena). Phys. Rev. 104, 107(1956) Oct. 1.

The threshold for neutron emission from the $Cu^{65}(p,n)Zn^{65}$ reaction has been measured to be 2.1653 ± 0.0015 Mev, relative to the $Li^7(p,n)Be^7$ threshold at 1.8811 Mev. The Q-value, -2.1322 ± 0.0015 Mev, is in close agreement with previous threshold measurements and with the results of the Zn^{65} β-decay and neutron scattering measurements. This indicates that compound nucleus resonances probably do not affect the determination of the Q-value for this reaction from the neutron threshold. (auth)

700

PHOTOPROTONS FROM Be, C, AND O. L. Cohen, A. K. Mann, B. J. Patton, K. Reibel, W. E. Stephens, and E. J. Winhold (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 104, 108-14(1956) Oct. 1.

The photoprotons ejected from thin foils of beryllium, carbon, and polyethylene and from oxygen gas by 25-Mev betatron bremsstrahlung were observed in nuclear emulsions with good resolution. The energy distributions and yields of photoprotons were determined for Be, C, and O. Excitation functions for transitions to the ground states of the residual nuclei have been constructed from the observed photoproton energy distributions of C and O. Structure is observed in the proton energy distributions and hence appears in the corresponding (γ,p) excitation functions. This structure is in rough agreement with that observed in (γ,n) reactions in C and O. (auth)

701

EXCITATION FUNCTIONS FOR TWO NITROGEN–SODIUM NUCLEAR REACTIONS. M. L. Halbert, T. H. Handley, and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 104, 115-17(1956) Oct. 1.

Excitation functions were measured for two nitrogen-induced nuclear reactions on sodium, $Na^{23}(N^{14},\alpha p)P^{32}$ and $Na^{23}(N^{14},\alpha 2p)Si^{31}$. The total cross section at 26 Mev for the first reaction is 91 ± 18 millibarns and for the second reaction 4.1 ± 0.8 millibarns. A calculation based on the statistical model of the nucleus gives a value of about 50 for the ratio of $\sigma_p 32/\sigma_{Si} 31$, which may be compared with the experimental ratio of 22 ± 5. (auth)

702

PICKUP BEHAVIOR IN $Li^6(p,He^3)He^4$ AND $F^{19}(p,\alpha)O^{16}$ AT 18 MEV. J. G. Likely and F. P. Brady (Princeton Univ., N. J.). Phys. Rev. 104, 118-23(1956) Oct. 1.

Differential cross sections were measured for $F^{19}(p,\alpha)O^{16}$, to the ground state, and for $Li^6(p,He^3)He^4$. The angular distribution from $F^{19}(p,\alpha)O^{16}$ shows three maxima, which can be fitted approximately by the Born approximation for triton pickup. Empirical adjustment of phase, in the theoretical distribution, gives a better fit with a smaller nuclear radius. The cross section at 18.5 Mev is 1.5 times larger than at 16 Mev. The angular distribution of He^3 particles from $Li^6(p,He^3)He^4$ shows a maximum at zero degrees, explained qualitatively by deuteron pickup. Cross sections, at 18.5 and 15 Mev, are 1.1 and 1.7 times smaller, respectively, than expected, through pickup theory, from published 14-Mev data on $Li^6(n,t)He^4$. Maxima observed at 110 and 180 degrees are examined in terms of direct interaction between the proton and alpha particle in Li^6; results are inconclusive, due to inadequacies of current theory. The pickup cross sections give reasonable values of triton and deuteron reduced widths in F^{19} and Li^6, respectively. (auth)

703

POLARIZATION OF PROTONS FROM DEUTERON STRIPPING IN CARBON. Peter Hillman (Atomic Energy Research Establishment, Harwell, Berks, England). Phys. Rev. 104, 176-8(1956) Oct. 1.

The polarization of protons from the stripping of 4-Mev deuterons in carbon at 30° has been measured by scattering in helium. The value of $P = -58\% \pm 13\%$ is larger than, but the sign is in agreement with, predictions based on a simple stripping-plus-potential scattering picture. (auth)

704

CROSS SECTIONS FOR PHOTONEUTRON EMISSION INDUCED BY THE LITHIUM GAMMA RAYS. W. H. Hartley, W. E. Stephens, and E. J. Winhold (Univ. of Pennsylvania, Philadelphia). Phys. Rev. 104, 178-82(1956) Oct. 1.

Cross sections for emission of photoneutrons produced by $Li^7(p,\gamma)$ gamma rays in thirteen middle-weight and heavy nuclei have been measured. Neutrons were detected by BF_3 counters embedded in paraffin, and the gamma-ray intensity was measured with a NaI scintillation detector. Measurements made with two groups of neutron counters whose efficiencies depended differently on neutron energy indicated that the energy distributions of the emitted neutrons are evaporation-like in shape. The present cross section values are about 20% higher than previous measurements of McDaniel, Walker, and Stearns, but the difference is within the combined errors. The measurements provide an independent check on the accuracy of the cross-section curves obtained with bremsstrahlung beams; agreement is obtained with University of Pennsylvania betatron data but not with some other betatron results. (auth)

705

YIELDS OF THE $O^{18}(p,\alpha)N^{15}$ AND $O^{18}(p,n)F^{18}$ REACTIONS FOR PROTONS OF 800 KEV TO 3500 KEV. H. A. Hill and J. M. Blair (Univ. of Minnesota, Minneapolis). Phys. Rev. 104, 198-201(1956) Oct. 1.

The yield of the $O^{18}(p,\alpha)N^{15}$ reaction was observed at 90° with respect to the ion beam for protons from 800 kev to 3500 kev. Resonances in the yield located fifteen energy levels in F^{19} not previously observed. Neutrons from the $O^{18}(p,n)F^{18}$ reaction were observed in the forward direction above the threshold ($E_p = 2577 \pm 8$ kev). Simultaneous observation of alpha particles and neutrons showed that the resonance energies for the two reactions agree in some cases but not in others. (auth)

706

(d,p) REACTIONS WITH Kr^{78} AND Kr^{80}. N. C. Blais and W. W. Watson (Yale Univ., New Haven, Conn.). Phys. Rev. 104, 202-4(1956) Oct. 1.

Three targets of krypton gas, the first analyzing Kr^{78} 45%, Kr^{80} 51%, Kr^{82} 3.8%, the second Kr^{78} 28%, Kr^{80} 65%, Kr^{82} 6.3%, and the third Kr^{78} 14.2%, Kr^{80} 69.8%, Kr^{82} 14.4%, were produced by the thermal diffusion separation process. The (d,p) reactions for these samples were studied with the

4-Mev deuteron beam of the Yale cyclotron. The ground state and first excited state Q values of Kr^{79} are 5.98 ± 0.05 Mev and 5.52 ± 0.05 Mev, respectively. The ground state Q value of Kr^{81} is tentatively set at 5.63 ± 0.1 Mev. The masses of Kr^{79} and Kr^{81} are 78.94530 ± 11 and 80.94249 ± 14 amu. (auth)

707

THE CROSS SECTION AND ANGULAR DISTRIBUTIONS OF THE D-D REACTIONS BETWEEN 40 AND 90 KEV. D. L. Booth, G. Preston, and P. F. D. Shaw (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A69, 265-70(1956) Mar. 1.

A thin gas target was used for measurements of the cross sections and angular distributions of the He^3 and H^3 disintegration products at bombarding energies of 52 and 87 kev, two symmetrically placed proportional counters being used as detectors. The angular range covered was from 18 to 150° in the laboratory coordinate frame. In addition, the ratio of the differential cross sections of the reactions was measured for a laboratory angle of 48° at bombarding energies of 39 and 65 kev. The results obtained are consistent with earlier measurements using the same technique, and show that the neutron-producing reaction has the greater anisotropy, and that the ratio of the total cross sections is energy dependent. (auth)

708

AN INVESTIGATION OF THE γ-RAYS FROM THE REACTIONS $^{24}Mg(p,\gamma)^{25}Al$ AND $^{12}C(p,\gamma)^{13}N$, WITH A NOTE ON THE POSITRON DISINTEGRATION OF ^{25}Al. D. R. Chick, W. W. Evans, D. A. Hancock, S. E. Hunt, and R. A. Pope (Associated Electrical Industries Ltd., Aldermaston, Berks, England). Proc. Phys. Soc. (London) A69, 624-7 (1956) Aug. 1.

C^{12} and Mg^{24} targets were irradiated by protons of energy 456.8 kev and 225.5 kev corresponding to the formation of excited levels in N^{13} and Al^{25} of energy 2.37 and 2.50 Mev respectively. The gamma-ray spectra were investigated using a 20-mm cube NaI crystal and photomultiplier feeding into a Hutchinson–Scarrott type pulse height analyser. A single γ ray was observed from the 2.37 Mev state in N^{13}. Peaks observed from Al^{25} could best be explained in terms of excited levels at 0.46, 1.54, and 2.5 Mev. A search was made for γ radiation accompanying the positron decay of Al^{25} to Mg^{25}. The only peak observed was one at 0.51 Mev corresponding to annihilation radiation. It therefore seems probable that a simple positron transition between the Al^{25} and Mg^{25} ground state takes place. (auth)

709

THE REACTION $^{24}Mg(p,\gamma)^{25}Al$. J. Varma (Univ. of Glasgow, Scotland). Proc. Phys. Soc. (London) A69, 641-5 (1956) Aug. 1.

Gamma-ray spectra, angular distributions, and angular correlation of γ rays were studied in an investigation of the reaction at a proton energy of 222 kev, with the aim of determining the spins and parities of some of the lower excited states of Al^{25}. (F.S.)

710

INVESTIGATION OF GAMMA-RAYS EMITTED BY NUCLEI OF CALCIUM, NICKEL, AND POTASSIUM ON CAPTURING THERMAL NEUTRONS. B. P. Adyasevich, L. V. Groshev, A. M. Demidov, and V. N. Lutsenko. Soviet J. Atomic Energy, No. 2, 171-82(1956).

The energies and intensities of γ rays emitted by nuclei of calcium, nickel and potassium when they capture thermal neutrons were measured by a magnetic spectrometer which analyzes the Compton electrons. The γ-ray spectra were studied in the energy interval 0.25 to 12 Mev. The intensities of γ ray are expressed in terms of the number of γ quanta emitted per 100 neutrons captured. Possible γ-transition diagrams have been constructed for Ca^{41}, Ni^{59}, Ni^{61} and K^{40} nuclei. The present work is a continuation of the investigation of γ rays emitted by nuclei on capturing thermal neutrons which is being carried out with the RFT reactor of the Academy of Sciences of the USSR. The experimental conditions, the method of measurement and the spectrometer have all been described before. Results are given on the investigation of γ rays from the nuclei of calcium, nickel and potassium. (auth)

711

INVESTIGATION OF GAMMA-RAYS EMITTED BY NUCLEI OF TITANIUM, IRON, AND SILICON ON CAPTURING THERMAL NEUTRONS. B. P. Adyasevich, L. V. Groshev, and A. M. Demidov. Soviet J. Atomic Energy, No. 2, 183-92(1956).

The energies and intensities of γ rays arising when thermal neutrons are captured in titanium, iron and silicon were measured by a magnetic spectrometer which analyzes the Compton electrons. The γ-ray spectra were studied in the energy interval 0.25 to 12 Mev. The intensities of the γ rays are expressed in terms of the number of γ quanta per 100 neutron captures. Possible γ-transition schemes have been constructed for Ti^{49}, Fe^{57} and Si^{29} nuclei. The present work is a continuation of the study of γ spectra, emitted by nuclei after capturing thermal neutrons, carried out with the aid of a magnetic γ spectrometer. In the present paper are given the results of the measurement of the energies and of the intensities of γ rays emitted by the nuclei of titanium, iron and silicon. The measurement of the intensity (number of γ quanta per capture) was carried out by means of normalizing the radiated energy to the binding energy of the neutron in the nucleus under investigation. (auth)

712

ON THE NUMBER OF NEUTRONS EMITTED BY Pu^{239} ON FISSION BY THERMAL AND SUPERTHERMAL NEUTRONS. V. I. Kalashnikova, V. I. Lebedev, L. A. Mikaelian, and M. I. Pevzner. Soviet J. Atomic Energy, No. 3, 291-3(1956).

The average number of neutrons emitted on fission of Pu^{239} by thermal and superthermal neutrons (E_w from 0.15 to 0.5 ev) is measured. (auth)

713

DETERMINATION OF THE AVERAGE NUMBER OF NEUTRONS ν_{eff} EMITTED IN A SINGLE CAPTURE EVENT BY THE ISOTOPES U^{233}, U^{235} AND Pu^{239} IN THE SUPERTHERMAL REGION OF NEUTRON ENERGIES. P. E. Spivak, B. G. Erozolimsky, G. A. Dorofeev, V. N. Lavrenchik, I. E. Kutikov, and Yu. P. Dobrynin. Soviet J. Atomic Energy, No. 3, 295-302(1956).

The variation of ν_{eff} for the isotopes U^{233}, U^{235} and Pu^{239} is measured in the superthermal region of neutron energies. For U^{233} ν_{eff} remains constant up to an energy of the order of 100 ev. For Pu^{239} ν_{eff} drops by 12% on going from the thermal spectrum to the spectrum of energies from 0.15 to 0.5 ev, and then remains constant. For U^{235} ν_{eff} remains constant on going from the thermal spectrum to the spectrum of energies from 0.15 to 0.5 ev, and then drops by 18% on going to the spectrum of energies from 8 to 130 ev. (auth)

714

THE AVERAGE NUMBER OF NEUTRONS ν_{eff} EMITTED BY THE ISOTOPES U^{233}, U^{235} AND Pu^{239} ON CAPTURE OF NEUTRONS WITH ENERGIES FROM 30 TO 900 kev. P. E. Spivak, B. G. Erozolimsky, G. A. Dorofeev, V. N. Lavrenchik, I. E. Kutikov, and Yu. P. Dobrynin. Soviet J. Atomic Energy, No. 3, 303-9(1956).

Measurements are made on ν_{eff} for the isotopes U^{233}, U^{235} and Pu^{239} for neutrons with energies from 30 to 900 kev. It is discovered that in this energy region ν_{eff} increases substantially as the neutron energy increases. (auth)

715

ANGULAR DISTRIBUTION OF NEUTRONS FROM THE REACTIONS $B^{10}(d,n)C^{11}$ AND $N^{14}(d,n)O^{15}$ AT 0.85 MEV BOMBARDING ENERGY. Arnfinn Graue (Univ. of Bergen, Norway). Univ. Bergen Arbok, Naturvitenskap. Rekke, Nos. 1-12, 3-7(1955).

The angular distribution and energy spectra of neutrons from the $B^{10}(d,n)C^{11}$ and $N^{14}(d,n)O^{15}$ reactions have been measured at 0.85-Mev bombarding energy, using the photographic plate technique. The experimental results show that both stripping and compound nucleus formation contribute to the angular distributions. (auth)

PARTICLE ACCELERATORS

716 MURA-201

Midwestern Universities Research Assn., Urbana, Ill. NUMERICAL TECHNIQUES. Harry Denman. Oct. 19, 1956. 16p. Contract AT(11-1)-384. $3.30(ph OTS); $2.40(mf OTS).

The most important MURA digital computer programs for studying particle orbits in the spiral sector FFAG accelerator are reviewed in some detail. Several suggestions are given for improving the speed and accuracy of these computations. (auth)

717 UCRL-1820

California. Univ., Berkeley. Radiation Lab. PROPOSED R. F. BUNCHER FOR A-12. S. A. Colgate. June 25, 1952. Decl. Sept. 10, 1956. 30p. Contract W-7405-eng-48. $6.30(ph OTS); $3.00(mf OTS).

A buncher and pre-accelerator of A-12 is described that has 360° phase acceptance and could handle current of 1 amp from a low voltage source. (auth)

718 UCRL-3428

California. Univ., Berkeley. Radiation Lab. SLOW AND FAST STRUCTURE OF SECONDARY-PARTICLE BEAMS OF THE BEVATRON. Harry G. Heard. July 5, 1956. 18p. Contract W-7405-eng-48. $0.20(OTS).

A coordinated investigation of the structure of the secondary-particle beams of the Bevatron was made. The debunching and spiral in time of the primary beam have been determined for typical experimental conditions. Two of the methods of secondary-beam production, which are discussed here, have been used extensively in cloud-chamber and counter-type experiments. Three new methods of secondary-beam production have been studied in some detail. The radiofrequency structure, synchrotron oscillation structure, magnet-ripple structure, and duration of the secondary-beam pulse are reported for each of these methods. (auth)

719 AEC-tr-2641

CORRECTION OF THE CONSTANT GRADIENT FIELD. H. Bruck, G. Bronca, J. Hamelin, G. Neyret, and J. Parain. Translation of paper presented at European Organization for Nuclear Research (CERN), Symposium 1956. 32p.

Correction methods are given for assuring the constancy of the field index of an accelerator magnet during the growth of the field. The method of correction by growing the pole faces is described. The theory is developed and the results of measurement are given. A description is given of a less effective method of correcting the field by damping air-gaps. Results of measurements are given, showing the possible advantage of giving the pole pieces a convex slope shape instead of a rectangular shape. (J.H.M.)

720

NOTES ON THE ISODOSE CURVES FROM A 2 MEV VAN DE GRAAFF MACHINE. Peter Wootton (Tumor Inst. of the Swedish Hospital, Seattle, Wash.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 929-33(1956) Nov.

721

FIELD LOCALIZATION FOR BETATRON THERAPY. Jasper E. Richardson, Earl Van Roosenbeek, and Jack M. Morgan (M. D. Anderson Hospital and Tumor Inst., Houston, Tex.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 76, 934-8(1956) Nov.

722

ELECTROSTATIC GENERATOR. S. D. Winter (Center d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 995-1005(1955) Nov. (In French)

The principles of Van de Graaff accelerators are reviewed, and complete diagrams of the accelerator are given. Discussions are also given on the limitations of the accelerator, the field characteristics, ion sources, and accelerator tubes. (B.J.H.)

723

GENERAL PRINCIPLES OF THE AUTOMATIC VOLTAGE REGULATION OF THE SACLAY VAN DE GRAAFF ACCELERATOR. Gérard Lehmann (Commissariat a l'Energia Atomique, Paris). L'Onde Électrique 35, 1006-8(1955) Nov. (In French)

724

IONIC OPTICS OF THE VAN DE GRAAFF BEAM. H. Bruck and G. Gendreau (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1009-21(1955) Nov. (In French)

The beam optics in the Van de Graaff are analyzed mathematically. The choice of a monochromator is also discussed in detail. (B.J.H.)

725

REGULATION OF THE FIELD OF THE VAN DE GRAAFF BEAM DEFLECTION ELECTROMAGNET. A. Gabet (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1022-9(1956) Nov. (In French)

Detailed descriptions are given of the Van de Graaff electromagnet and its control system. (B.J.H.)

726

REGULATION OF THE BEAM POSITION IN THE SACLAY VAN DE GRAAFF. D. Pinet (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1030-2(1955) Nov. (In French)

The circuits used to regulate the beam position in the Saclay Van de Graaff are shown. (B.J.H.)

727

VOLTAGE REGULATION IN THE SACLAY VAN DE GRAAFF GENERATOR. A. Gabet and J. Taieb (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1033-47(1955) Nov. (In French)

The general characteristics of voltage regulator systems are discussed. A complete discussion is also given on the stability of the regulators. (B.J.H.)

728

THE C.E.A. CYCLOTRON AT SACLAY. P. Debraine (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1048-51(1955) Nov. (In French)

A general description is given of the Saclay cyclotron including the characteristics of the electromagnet, the vacuum chamber, high-frequency equipment, and ion sources. The high-frequency problems of the cyclotron are also discussed briefly. (B.J.H.)

729

HF CIRCUITS OF THE CYCLOTRON. A. Barlaud (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1052-63(1955) Nov. (In French)

A general description is given of h-f circuits for the cyclotron. Also included are detailed discussions of the mechanical realization of resonant circuits and the theory and design of oscillator circuits. (B.J.H.)

730

STUDY OF A PULSED SOURCE OF DEUTERONS. J. Moreau, F. Prevot, and R. Vienet (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 1064-9(1955) Nov. (In French)

A pulsed source of deuterons for a Van de Graaff accelerator is described. Diagrams of the associated electronic circuits are given. (B.J.H.)

731

FIXED-FIELD ALTERNATING-GRADIENT PARTICLE ACCELERATORS. K. R. Symon, D. W. Kerst, L. W. Jones, L. J. Laslett, and K. M. Terwilliger (Midwestern Universities Research Assoc.). Phys. Rev. 103, 1837-59(1956) Sept. 15.

It is possible, by using alternating-gradient focusing, to design circular accelerators with magnetic guide fields which are constant in time, and which can accommodate stable orbits at all energies from injection to output energy. Such accelerators are in some respects simpler to construct and operate, and moreover, they show promise of greater output currents than conventional synchrotrons and synchrocyclotrons. Two important types of magnetic field patterns are described, the radial-sector and spiral-sector patterns, the former being easier to understand and simpler to construct, the latter resulting in a much smaller accelerator for a given energy. A theory of orbits in fixed-field alternating-gradient accelerators has been worked out in linear approximation, which yields approximate general relationships between machine parameters, as well as more accurate formulas which can be used for design purposes. There are promising applications of these principles to the design of fixed-field synchrotrons, betatrons, and high-energy cyclotrons. (auth)

732

THE PROTON SYNCHROTRON. J. P. Blewett (Brookhaven National Lab., Upton, N. Y.). Repts. Progr. in Phys. 19, 37-79(1956).

Three proton synchrotrons are now in operation in the energy range above 1000 Mev (1 Bev). A 1-Bev machine has been constructed at the University of Birmingham and 3- and 6-Bev machines are located at the Brookhaven National Laboratory (N. Y.) and the Berkeley Radiation Laboratory (California). A general description of these three synchrotrons is preceded by a brief presentation of the applicable proton dynamics. A survey is also included of the salient features of a 10-Bev air-cored proton synchrotron under construction at Canberra (Australia). The discovery of alternating-gradient focusing has made possible the design of proton synchrotrons in the 10 to 50-Bev range. The dynamics of protons in alternating-gradient fields are discussed and design data are presented for machines to be constructed by Brookhaven and by the European Organization for Nuclear Research in Geneva, Switzerland. A novel application of the new focusing method evolved by the Midwest Universities Research Association (U.S.A.) is also explained. (auth)

733

STUDIES WITH A THREE-DEE THREE-PHASE PROTON CYCLOTRON. Lawrence Ruby, Myron Heusinkveld, Mark Jakobson, Bob H. Smith, and Byron T. Wright (Univ. of California, Berkeley and Los Angeles). Rev. Sci. Instr. 27, 490-3(1956) July.

As part of the program to investigate the properties of the Thomas cyclotron, a 20-in. diam proton cyclotron was constructed. In such a three-dee three-phase system it is possible to accelerate protons, deuterons, and tritons at the same setting of frequency and magnetic field but on different modes of the rf. For stable operation in the proper mode and with balanced voltages, it has been found necessary to provide both phase servos and amplifier efficiency servos. The dees could not be servoed individually until the inter-dee capacity was neutralized. Under such conditions it was possible to attain steadily 6.0 ma of protons at 1.0 Mev in the forward mode and 6.5 ma of deuterons at 0.5 Mev in the reverse mode. (auth)

RADIATION ABSORPTION AND SCATTERING

734 SCEL-TM-1707

Evans Signal Lab., Belmar, N. J.

A GAMMA-RAY SPECTROSCOPIC ANALYSIS TECHNIQUE. (As of September 20, 1955). Stanley H. Ungar. Nov. 1, 1955. DA Project No. 3-12-10-000. (AD-89553).

A technique is developed for analyzing the pulse height distribution associated with photoelectric and Compton absorption in crystals in terms of the incident gamma spectral distribution. (F.S.)

735

ON SCATTERING OF ZERO-SPIN PARTICLES, CONSIDERING THE ATTENUATION. A. A. Sokolov and B. K. Kerimov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 108, 611-14(1956) June 1. (In Russian)

Previous investigations of particle scatterings considering the attenuation, revealed the effective cross section of Dirac particles scattered by δ-shaped stable nuclear force. The attenuation method was applied for the case where scattering stable nucleus had a spherical symmetry and small radius. (R.V.J.)

736

X-RAY SCATTERING BY LIQUID-METAL ALLOYS (A KINETIC APPROACH). Rufus C. Ling (Univ. of Missouri, Columbia). J. Chem. Phys. 25, 614-16(1956) Oct.

The Born-Green theory of liquids is extended to the case of liquid mixtures, and a formula for the x-ray scattering by such liquids is developed. The formula is used to calculate the x-ray scattering by a liquid sodium-potassium alloy, and fair agreement with the experimental scattering is found. (auth)

737

SOFT X-RAY ABSORPTION EDGES OF METAL IONS IN COMPLEXES. I. THEORETICAL CONSIDERATIONS. F. Albert Cotton and Carl J. Ballhausen (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 25, 617-19(1956) Oct.

The effect of crystal field symmetry on the appearance of K x-ray absorption edges of metal ions in complexes is considered. In particular, the splitting of the $1s-4p$ absorption for first row transition elements is related to the splitting of the degeneracy of the 4p energy levels in the ion by the crystal field. (auth)

738

SOFT X-RAY ABSORPTION EDGES OF METAL IONS IN COMPLEXES. II. Cu K EDGE IN SOME CUPRIC COMPLEXES. F. Albert Cotton (Harvard Univ., Cambridge) and Harold P. Hanson (Univ. of Texas, Austin). J. Chem. Phys. 25, 619-23(1956) Oct.

It is shown that the crystal field splitting of the 4p orbitals of Cu(II) in some complexes can be correlated with the splitting of the $1s-4p$ transition observed in studies of the K absorption edges of these complexes, provided the ligand-metal bonding is not appreciably covalent. (auth)

739

SCATTERING OF HIGH VELOCITY NEUTRAL PARTICLES. VII. XENON–XENON. I. Amdur and E. A. Mason (Massa-

chusetts Inst. of Tech., Cambridge). J. Chem. Phys. 25, 624-5(1956) Oct.

Measurements have been made of the scattering of xenon atoms with energies between 700 and 2100 ev in room temperature xenon. The interaction potential for two xenon atoms, deduced from the variation of the total collision cross sections with energy, may be expressed as $V(r) = 1.13 \times 10^{-8}/r^{7.97}$ ergs for r between 3.01 A and 3.60 A. This potential is consistent with others, valid at larger separation distances, which have been obtained from measurements of gaseous compressibility, transport, and crystal properties, within the limits of uncertainty of the potentials at the larger distances. (auth)

740

ENERGY OF INTERACTION BETWEEN A HYDROGEN ATOM AND A HELIUM ATOM. E. A. Mason (Univ. of Maryland, College Park) and J. Ross and P. N. Schatz (Brown Univ., Providence, R. I.). J. Chem. Phys. 25, 626-9(1956) Oct.

The potential energy of interaction between a H atom and a He atom has been calculated as a function of separation distance by standard quantum mechanical variation procedures. The approximate molecular wave functions used contained both homopolar and ionic contributions, and were constructed from 1s hydrogen-like atomic wave functions. All integrals involved have been evaluated accurately. The results are in agreement with a potential determined from measurements of the scattering of high velocity H atoms in He gas. For separation distances greater than 1 A, the results have been combined with an estimate of the potential of the London dispersion forces, and the combination has been represented by an exp-six potential useful in the calculation of properties of gases. (auth)

741

SCATTERING OF HIGH VELOCITY NEUTRAL PARTICLES. VIII. H–He. I. Amdur and E. A. Mason (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 25, 630-2(1956) Oct.

Total collision cross sections have been measured for H atoms with energies between 700 and 2100 ev, scattered in room temperature He. The results have been analyzed to obtain potential energy information for the interaction between a H atom and a He atom. The potential function, which may be represented by $V(r) = 3.75 \times 10^{-12}/r^{3.29}$ erg for r between 1.16 A and 1.71 A, gives values which agree with those calculated quantum mechanically by Mason, Ross, and Schatz. The H–He potential has been combined with a potential previously obtained for He–He to obtain a function which, it is suggested, represents the repulsive interaction between two hydrogen atoms. The derived function is in fair agreement with theoretical calculations of Hirschfelder and Linnett for the repulsive $^3\Sigma$ state of the hydrogen molecule. (auth)

742

SCATTERING OF HIGH VELOCITY NEUTRAL PARTICLES. IX. Ne–A; A–Ne. I. Amdur and E. A. Mason (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 25, 632-4(1956) Oct.

Total collision cross sections have been measured for neon atoms with energies between 500 and 2100 ev, scattered in room temperature argon, and for argon atoms with the same energies scattered in room temperature neon. The experimental results have been analyzed to obtain the following potential energy of interaction between a neon atom and an argon atom: $V(r) = 1.01 \times 10^{-9}/r^{9.18}$ erg, for r between 1.91 A and 2.44 A. This potential is in agreement with one obtained by a simple combination of the potential between two neon atoms with that between two argon atoms. It is also consistent with the potential, valid at larger separation distances, which has been derived from measurements of gaseous compressibility, viscosity, and crystal properties. (auth)

743

HIGH ENERGY INELASTIC DIFFRACTION PHENOMENA. E. L. Feinberg and I. Pomerančuk (Academy of Sciences of the USSR, Moscow). Nuovo cimento (10) 3, Suppl. No. 4, 652-71(1956).

A survey is made of recent theoretical papers on processes arising in the course of collisions of high-energy particles. Consideration is given to the electromagnetic phenomena accompanying nuclear collisions, purely electromagnetic processes such as bremsstrahlung, and nuclear phenomena such as meson emission, deuteron splitting, and nucleon-nucleus collisions. (B.J.H.)

744

ELASTIC SCATTERING OF ELECTRONS AND POSITRONS BY POINT NUCLEI. J. A. Doggett and L. V. Spencer (National Bureau of Standards, Washington, D. C.). Phys. Rev. 103, 1597-1601(1956) Sept. 15.

The Mott cross section has been systematically tabulated, by means of an electronic computer, for intermediate relativistic energies. Results are presented at 15° angular intervals, for electrons and positrons, for Z = 6, 13, 29, 50, 82 and 92 and for energies 10, 4, 2, 1, 0.7, 0.4, 0.2, 0.1, and 0.05 Mev. Intercomparisons with earlier results are presented, as well as a subsidiary tabulation of a function important in the limit $\theta \to 0$. (auth)

745

ELECTRON CHARACTERISTIC ENERGY LOSSES IN METALS AND COMPOUNDS. Lewis B. Leder (National Bureau of Standards, Washington, D. C.). Phys. Rev. 103, 1721-6(1956) Sept. 15.

The characteristic energy loss spectra of electrons in the metals Al, C, Sb, Ca, Pb, Na, and Te and compounds of these metals have been measured with an improved measuring technique designed to give more reliable intensity relationships, and it is found that, with the exception of Al_2O_3, the compound spectra show a decided similarity to the spectra of their parent metal spectra. Rudberg's premise that such a similarity is due to oxidation of the parent metal is shown not to hold. It is proposed that the characteristic losses, except in the case of Al, and possibly Be and Mg, are due to interband transitions. For Al, and possibly Be and Mg, the characteristic losses may be due to excitation of a free electron plasma. (auth)

746

ELASTIC AND INELASTIC SCATTERING OF 31.5-MEV ALPHA PARTICLES BY LIGHT NUCLEI. Harry J. Watters (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 103, 1763-72(1956) Sept. 15.

Using the 31.5-Mev alpha-particle beam of the Massachusetts Institute of Technology cyclotron, a study has been made of the angular distributions obtained in the (α,α) and (α,α') interactions on Li^6, C^{12}, and Mg^{24}. Separation of the alpha particles from other products of the alpha-induced reactions was accomplished by a dE/dx and E two-crystal technique developed at the cyclotron laboratory. The experimental inelastic angular distributions are shown to be in agreement with those predicted by the direct surface interaction theory. The experimental elastic angular distributions are compared with the diffraction of light by an opaque sphere. The probabilities of excitation of isotopic spin "forbidden" and "allowed" levels were also obtained for specified levels of Li^6 and N^{14}. (auth)

747

PROTON-PROTON SCATTERING EXPERIMENTS AT 170

AND 260 MEV. Owen Chamberlain and John D. Garrison (Univ. of California, Berkeley). Phys. Rev. 103, 1860-70 (1956) Sept. 15. (cf. NSA 8-6580)

The differential proton-proton scattering cross section has been measured at 170 and 260 Mev for laboratory angles of 4.4° to 30°. The proton beam was obtained by reducing the energy of the 345-Mev beam of Berkeley cyclotron. A liquid-hydrogen target was used. Counting was done with a telescope of two liquid scintillation counters. A Faraday cup served as a standard for beam calibration. The results indicate a cross section, in the center-of-mass system, independent of energy, and rather independent of angle, outside of the Coulomb region. The level of the differential cross section is close to 3.6 millibarns per steradian. An approximate treatment indicates there is destructive interference between nuclear and Coulomb scattering. It is concluded that the real part of the nuclear scattering amplitude must be positive at small angles. (auth)

748

CALCULATION OF NUCLEON-NUCLEON SCATTERING FROM THE GARTENHAUS POTENTIALS. J. L. Gammel and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 103, 1874-6(1956) Sept. 15.

Nucleon-nucleon scattering and polarization are computed by using potentials calculated by Gartenhaus from the cutoff pseudoscalar symmetric meson theory proposed by Chew. The results are compared with experiment. (auth)

749

DISPERSION RELATIONS FOR FINITE MOMENTUM-TRANSFER PION-NUCLEON SCATTERING. R. H. Capps (Univ. of California, Berkeley) and Gyo Takeda (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1877-96(1956) Sept. 15.

The field-theoretical derivation of dispersion relations for forward pion-nucleon scattering has been generalized to apply to the case of a fixed finite momentum transfer. The generalization is facilitated by use of the special Lorentz frame in which the sum of the momenta of the initial and final nucleons is zero. In this reference system the relations between dispersive and absorptive parts of the scattering amplitude are independent of momentum transfer and are similar in form to the forward-angle relations. At energies below the minimum energy necessary to allow a particular momentum transfer, the scattering amplitude has no direct physical meaning; it is interpreted as an analytic continuation of the physical amplitude to scattering angles corresponding to $\cos\theta < -1$. The resulting equations are expressed in terms of the amplitudes for individual angular momenta and are given in two forms, corresponding to the inclusion or neglect of nucleon recoil. (auth)

750

RELATION BETWEEN ENERGY AND HALF-THICKNESSES FOR ABSORPTION OF BETA RADIATION. W. F. Libby (Carnegie Institution of Washington, D. C.). Phys. Rev. 103, 1900-1(1956) Sept. 15.

The relation between the half thickness in Al and the upper energy limit, E, of the β spectrum involved was found to be $1\frac{1}{2}$ $(mg/cm^2) = 38 \times (E^{\frac{5}{3}})$. Pertinent data are given in graphical form. The relationships for other materials are also discussed. (B.J.H.)

751

ALPHA-ALPHA SCATTERING AT LOW ENERGIES. N. P. Heydenburg and G. M. Temmer (Carnegie Institution of Washington, D. C.). Phys. Rev. 104, 123-34(1956) Oct. 1.

The differential cross section was measured for the scattering of α particles in He between laboratory angles of 10 and 80 degrees and in the energy range 150 kev to 3 Mev, using He^+ ions from the electrostatic generators. Below 400 kev no nuclear interaction occurs within the accuracy of the experiments (±1%), and Mott's formula for the Coulomb scattering of identical zero-spin particles is verified in detail. Above 400 kev the nuclear s-wave interaction begins to contribute, starting at a phase shift K_0 near π, and smoothly decreasing with increasing energy is about 128 degrees at 3 Mev. Starting at 2.5 Mev, a small d-wave phase shift, K_2 is found necessary to account for the observed angular distributions, reaching a value of 2.5 degrees at 3 Mev. Absolute values of the cross sections were determined by fitting the relative angular distributions with the single parameter K_0 below 2 Mev, and by comparison with Rutherford scattering in A above 2 Mev. The phase shift analysis was facilitated by a simple mechanical monograph described in an appendix. A careful survey of the low-energy region containing the ground state of Be^8, and the absence of any measurable effect leads to a lower limit for the mean life of the ground state of Be^8 of 2×10^{-16} sec. Combined with a recently established upper limit of 4×10^{-15} sec, this locates the lifetime to within a factor of twenty. (auth)

752

SCATTERING OF ALPHA PARTICLES FROM HELIUM. J. L. Russell, Jr., G. C. Phillips, and C. W. Reich (Rice Inst., Houston, Tex.). Phys. Rev. 104, 135-42(1956) Oct. 1.

Excitation curves and angular distributions for the scattering of α particles from helium have been obtained for bombarding energies of 3 to 6 Mev, using a differentially pumped gas scattering chamber and a singly charged α-particle beam from the Rice Institute Van de Graaff accelerator. A phase shift analysis of the data, yielding phase shifts accurate to about 2°, reveals that only S- and D-wave scattering occurs and shows that the well-known excited state at 2.9 Mev in Be^8 is a D state. The scattering data taken at the Department of Terrestrial Magnetism and the Universities of Illinois and Indiana are compared to the Rice Institute data by using the dispersion theory and the Landau K-function formalism developed for proton-proton scattering. The dispersion theory, applied to the Rice data, allows a rough estimate of the D-state level parameters, while the K function, applied to the Rice and D.T.M. data, is used to deduce a ground state width for Be^8 of 4.5±3 ev (c.m.). For excitation energies below 12 Mev, the scattering data are consistent with a description of the Be^8 nucleus as an interaction of two α-particles. Certain qualitative features of the potential of interaction of such a two-body configuration are discussed. (auth)

753

PROTON-PROTON SCATTERING AT 457 MEV IN A BUBBLE CHAMBER. Irwin A. Pless (Enrico Fermi Inst. for Nuclear Studies, Chicago). Phys. Rev. 104, 205-10(1956) Oct. 1.

This paper is an account of measurements of proton-proton scattering made with a negative-pressure bubble chamber. The experimental setup, beam, and operation cycle are described. A brief description of the bubble chamber is given and an analysis is made of errors associated with this technique. Total cross sections for carbon and hydrogen are measured and our data are fitted to an angular distribution which is the sum of the first five even Legendre polynomials. The results are: the total cross section for carbon is 317±17 millibarns; the total integrated cross section for hydrogen from 10° to 90° in the center-of-mass system is 25.8±2.3 millibarns. For our angular distribution, 507 events were used to determine a least squares fit to five parameters. The best fit is: $d\sigma/d\Omega = \{4.10 \pm 0.37\}\{(1.032 \pm 0.047)P_0 + (0.402 \pm 0.119)P_2 +$

$(0.149 \pm 0.172)P_4 + (0.198 \pm 0.209)P_6 + (0.507 \pm 0.249)P_8\}$ mb/sterad. (auth)

754

p-p SCATTERING IN THE BEV RANGE. W. Rarita (Brooklyn Coll., N. Y.). Phys. Rev. 104, 221-4(1956) Oct. 1.

Some general methods of attacking the p-p scattering problem in the Bev range are outlined. It is found that a fairly definitive phase shift analysis can be made if the orbital quantum number is limited to three and if j independence is assumed. For the 1-Bev case, the inequality $\sigma(0°) \geq (k\sigma_t/4\pi)^2$ (the minimum theorem) plays an essential role and facilitates the calculation. The phase shifts are found to depend on a single finite parameter. Detailed results are tabulated. The ray optical theory and the complex square-well potential are investigated and shown to be generally inadequate to describe the calculated phase shifts. A square-well potential with a central core suggests itself as a possible successful model. (auth)

755

INELASTIC SCATTERING OF LOW-ENERGY NEUTRONS BY LATTICE VIBRATIONS OF VANADIUM. R. S. Carter, D. J. Hughes, and H. Palevsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 271-2(1956) Oct. 1.

Standard chopper time-of-flight techniques were used to study the energy distribution of the neutrons scattered at 90° to the incident beam from a poly-crystalline sample of vanadium. Experimental results are compared graphically to theory. (B.J.H.)

756

SINGLE SCATTERING OF FAST ELECTRONS BY ATOMIC NUCLEI. K. K. Damodaran and R. M. Curr (Univ. Coll., London). Proc. Phys. Soc. (London) A69, 196-204(1956) Mar. 1.

An attempt has been made to check the validity of Mott's theory of single scattering of electrons by heavy nuclei such as Ag, Pt and U at various angles of scattering and thus to investigate whether there is any marked deviation from theory at large angles of scattering as observed by some previous workers in this field. An electron beam from a 4.5-Mev microtron was used for the experiment and the scattered electrons were detected in Ilford G5-50 micron emulsions. It has been found from these measurements that the scattering of 4.33 Mev electrons by the above mentioned nuclei agrees with Mott's theory within the experimental accuracy of a few per cent for angles of scattering from 45° to 90°. Measurements made at angles of scattering of 120° and 135° were found to have been affected by the presence of spurious scattering from the walls of the apparatus so that no definite conclusions can be drawn regarding the scattering at these angles. (auth)

757

NUCLEAR SCATTERING OF HIGH ENERGY ELECTRONS ON THE INDEPENDENT-PARTICLE MODEL. L. J. Tessie (Univ. of Melbourne, Australia). Proc. Phys. Soc. (London) A69, 205-13(1956) Mar. 1.

A simple independent-particle model is used to treat the elastic and inelastic scattering of electrons by light nuclei at high energies, using the relativistic first Born approximation. The matrix elements are calculated for a harmonic oscillator nucleus and a spherical box nucleus. Comparison is made with experiment for the scattering of 190-Mev electrons by Be^9. (auth)

758

PROTON-PROTON SCATTERING AT 134 MEV. A. E. Taylor and E. Wood (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 645-9(1956) Aug. 1.

The determination of the total cross section of H for 134-Mev protons, from which a value for the differential cross section at 90° center of mass can be obtained, is described. (F.S.)

759

PROTON-PROTON INTERACTIONS AT 650 MEV. A. P. Batson and L. Riddiford (Univ. of Birmingham, England). Proc. Roy. Soc. (London) A237, 175-85(1956) Oct. 9.

Protons of mean energy 650 Mev from the Birmingham proton synchrotron were passed through a hydrogen-filled diffusion cloud chamber located in a pulsed magnetic field, and a total of 317 interactions observed. Of these, 205 were elastic collisions and the remaining 112 involved the production of π^+ and π^0 mesons in the ratio 4.3 to 1. The elastic/inelastic ratio and the π^+/π^0 ratio agree with those obtained elsewhere; so also does the angular distribution of the elastically scattered protons, though the present experiment includes angles smaller than those covered in previous work. The elastic scattering is discussed in terms of the optical model of the nucleus and involves a radius of interaction of about 0.8×10^{-13} cm. Of events of the type $p + p \rightarrow n + p + \pi^+$, 53 were analyzed in detail and strong correlations were found between the directions of the proton and the meson, and of the proton and the neutron. These correlations, and the π^+/π^0 ratio, are consistent with an hypothesis due to Peaslee that at high energies such reactions proceed through an intermediate state of isotopic spin $I = 3/2$, involving the formation of an 'excited nucleon' which subsequently decays into a proton and a π^+-meson. The Q-value distributions for pairs of secondary particles in the above reaction also support this hypothesis. (auth)

760

THE PENETRATION OF GAMMA-RAYS THROUGH WATER, IRON, LEAD, AND COMBINATIONS OF IRON AND LEAD. S. G. Tsypin, V. I. Kukhtevich, and Yu. A. Kazansky. Soviet J. Atomic Energy, No. 2, 217-20(1956).

The dose rate attenuation of γ rays is measured in iron, water, and lead for "infinite" geometry. The dose rate attenuation of γ rays is measured in mixtures of iron and lead for "barrier" geometry. The experimental data obtained is compared with the results of calculations as presented previously. (auth)

Refer to abstract 653.

RADIATION EFFECTS

761 AERE-M/R-2009

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF METALS. PART I. TITANIUM AND ZIRCONIUM. M. J. Makin and F. J. Minter. July 1956. 20p.

The changes in mechanical properties of Ti and Zr after irradiation with 5×10^{19} neutrons/cm^2 have been studied at a variety of temperatures. The yield stress of annealed Ti increased by about 8,000 psi at all testing temperatures between −195 and +200°C. A yield point was developed at 200°C which indicates the migration to dislocations of vacancies produced by the irradiation. The elongation before fracture was reduced by the irradiation at all testing temperatures. The yield stress of heavily cold worked Zr decreased slightly at all testing temperatures after irradiation and the elongation before fracture increased. The reason for this "annealing" effect in heavily cold worked metal is discussed in terms of the atomic defects produced and also in terms of the Brinkman displacement spike mechanism. (auth)

762 NYO-7292

Brown Univ., Providence. Metals Research Lab.
RADIATION DAMAGE IN SOLIDS AS OBSERVED BY ULTRASONIC ATTENUATION AND VELOCITY MEASUREMENTS. First Annual Report [Covering Period] January 1, 1955–December 31, 1955. Rohn Truell. Jan. 1956. 36p. Contract AT(30-1)-1772. $6.30(ph OTS); $3.00(mf OTS).

Measurement of ultrasonic wave velocity and attenuation in solids yields considerable information about elastic constants, dislocation damping, and other important properties of solids. Such measurements have been made on Si, before and after reactor irradiation, and on alkali halides before, during, and after exposure in intense γ-ray sources. Results of irradiating other materials with γ-rays are mentioned briefly. Reactor irradiation increases the attenuation in silicon but this increase gradually disappears in about one year, when the sample stands at room temperature. The effects of reactor radiation on Si appear to be connected with dislocation damping. It is not yet clear that the effect of intense γ-ray irradiation of alkali halides is connected with dislocation damping; there may be electrical damping effects observed by ultrasonic attenuation. The effect of cold working on changes in attenuation caused by γ radiation in alkali halides is not yet settled although it seems clear that there are effects of this type. (auth)

763

RADIATION DAMAGE IN IONIC SOLIDS. J. H. O. Varley. J. Inst. Metals 84, 103-5(1956) Aug.

It is indicated that radiation will alter the resistance of a given metal towards oxidation and corrosion in general, as a result of physical changes in the protective film covering the metal, and quite apart from those induced by the radiation of the corrosive medium. The direction of the change will depend upon the details of the corrosion mechanism. From these arguments, it will be seen that a dominant factor in determining the extent to which the properties of the film are changed is the efficiency which ions are displaced by radiation. (auth)

764

CHANGES IN THE PROPERTIES OF URANIUM DURING BURN-UP. S. F. Puch. J. Inst. Metals 84, 105-8(1956) Aug.

Effects observable in U at a burn-up of about 10^{-6} are not qualitatively different from those observed when non-fissile materials are irradiated with fast neutrons. At a burn-up of about 10^{-4}, gross changes in shape arise from the anisotropic nature of U; while at higher burn-up the fission products themselves cause changes in physical and mechanical properties and may cause gross damage such as cracking and swelling. While most of the changes are fairly well understood the exact mechanisms cannot be decided until more is known of the physics of the solid state. (auth)

765

SEMI-CONDUCTORS AND NUCLEAR RADIATIONS. Lydie Koch (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électrique 35, 977-80(1955) Nov. (In French)

The permanent, reversible, and transitory radiation effects in semi-conductors are reviewed. (B.J.H.)

766

ON THE QUESTION OF THE NATURE OF RADIATION DAMAGE IN FISSIONABLE MATERIALS. S. T. Konobeevsky. Soviet J. Atomic Energy, No. 2, 208-16(1956).

A survey is given of the theory of radiation damage in materials irradiated by fast particles. An attempt is made to describe the processes of phase transformations under neutron irradiation of fissionable materials with the aid of diffusion equations. In this way an expression for the coefficient of diffusion D is obtained. The possible result of the effect of thermal spikes on the structure of the eutectoid $a + \gamma'$ is investigated for an annealed uranium molybdenum alloy. (auth)

767

SOME CHARACTERISTICS OF RADIATION VULCANIZATION. A. S. Kuzminsky, T. S. Nikitina, and V. L. Karpov. Soviet J. Atomic Energy, No. 3, 431-4(1956).

The radiation vulcanization of the following rubbers: natural rubber (NK), butadiene-styrene (SKS-30), butadiene (SKB-40) and nitrile (SKN-26) was investigated. The dependence of the relative rate of formation of the spatial structure and of the tensile strength on the integral radiation dosage was established. The question of the effect of certain ingredients of the rubber mixtures on the process of radiation vulcanization was examined. The peculiar role of carbon blacks and of the degree of their surface oxidation in the process was shown. (auth)

Refer to abstract 361.

RADIOACTIVITY

768 CU-148

Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. Pegram Lab.
COINCIDENCE BETA SPECTRA OF Rb^{86}, Sb^{122}, AND I^{126} (thesis). Work done in 1949–1951. Philip Alan Macklin. May 1, 1956. 70p. Contract AT-30-1-GEN-72. $12.30 (ph OTS); $4.50(mf OTS).

The development of a method for the investigation of the spectral shape of individual beta groups in a complex beta decay is discussed. The basic principle of the method is the incorporation of beta-gamma coincidence techniques with a high transmission magnetic spectrometer. This method was successfully applied to the cases of Rb^{86}, Sb^{122} and I^{126}. An attempt to interpret the results in terms of various possible first forbidden correction factors and other available information is presented. (auth)

769 DP-173

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
THE PREPARATION OF AN AMERICIUM GAMMA SOURCE. Robert C. Milham. Aug. 1956. 10p. Contract AT(07-2)-1. $0.15(OTS).

Americium^{241} was separated from La, Pu, and common metallic elements by ion exchange methods. The purified Am was embedded in plastic and mounted in a holder for use as a γ ray source. (auth)

770 UCRL-3488

California. Univ., Berkeley. Radiation Lab.
RADIOACTIVITY OF TIN-110, TIN-108, AND INDIUM-108 (thesis). Warren Mead. Aug. 6, 1956. 45p. Contract W-7405-eng-48. $7.80(ph OTS); $3.30(mf OTS).

An attempt has been made to extend the knowledge of the disintegration behavior of the Sn and In isotopes of mass numbers 108 and 110. Observations made with Sn sources obtained by α bombardment of enriched Cd isotopes indicate that the 4-hour Sn activity should be assigned to Sn^{110}, rather than to Sn^{108} as previously reported. The decay of In^{108} has been investigated, directly with the aid of enriched $Ag^{107}Cl$, and also as the daughter activity of Sn^{108}. The evidence obtained suggests a decay scheme for In^{108} which closely parallels that of In^{110}. The growth of a 3.5-Mev positron activity identified with the ground state of In^{108} has been interpreted in terms of an approximately 9-minute parent, and this half life has been tentatively assigned to Sn^{108}. Suggested decay schemes for these isotopes are presented. (auth)

771

ON THE GEOCHEMICAL STUDY OF CARBON 14. I. THE OZEGAHARA PEAT. Makoto Shima (Scientific Research Inst., Tokyo). Bull. Chem. Soc. Japan 29, 443-7(1956) June.

A method is described for dating sediment layers by C^{14} counting. Chemical techniques for processing the sample to be counted and counting instruments are discussed in detail. (W.L.H.)

772

HIGH-ENERGY FORBIDDEN β-RAY TRANSITIONS FROM Cs^{134} (2.3 yr.), Co^{60} (5.3 yr.), Sc^{46} (84 d.), and Hg^{203} (47.9 d.). J. L. Wolfson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Can. J. Phys. 34, 256-64(1956) Mar.

Beta-ray transitions of energies 1478 ± 6 kev from Co^{60} (5.3 yr.) and 1475 ± 6 kev from Sc^{46} (84 d.) were observed with intensities of $(1.0 \pm 0.2) \times 10^{-4}$ and $(3.6 \pm 0.7) \times 10^{-5}$ β rays per disintegration, respectively. Forbidden spectrum shapes were obtained for both transitions. No evidence was obtained for the β-ray transition of energy 1451 kev from Cs^{134} (2.3 yr.), nor for the transition of energy 473 kev from Hg^{203} (47.9 d.), and upper limits of 5×10^{-5} and 3×10^{-4} β rays per disintegration, respectively, are placed upon the intensities of these transitions. The log f_0t values are >14.5, 14.0 ± 0.1, 13.0 ± 0.1, and >11.3 for the transitions referred to from Cs^{134}, Co^{60}, Sc^{46}, and Hg^{203} respectively. (auth)

773

GAMMA-GAMMA ANGULAR CORRELATION IN W^{182}. R. C. Williams and K. I. Roulston (Univ. of Manitoba, Winnipeg, Canada). Can. J. Phys. 34, 1087-8(1956) Oct.

The three γ-ray cascades of W^{182} were investigated with a highly stabilized two-channel coincidence spectrometer. Correlation functions were established, and spin assignments made. (L.M.T.)

774

INVESTIGATION OF RADIOACTIVE DECAY CHAINS. V. S. Shpinel' and G. A. Kuznetsova (Moscow State Univ.). Soviet Phys. JETP 3, 216-24(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 231-42(1956) Feb. (In Russian)

Using a β spectrometer with two magnetic lenses and a γ spectrometer with NaI (Tl) scintillator, an investigation of the following transitions has been carried out: $Zr^{97} \rightarrow Nb^{97} \rightarrow Mo^{97}$; $Ru^{97} \rightarrow Tc^{97}$; $Ru^{105} \rightarrow Rh^{105} \rightarrow Pd^{105}$; and $Ru^{103} \rightarrow Rh^{103}$. The results obtained are generally in agreement with published decay schemes with the exceptions that a sample of $Zr^{97} + Nb^{97}$ emits a β spectrum with $E_\beta \sim 0.48$ Mev (intensity 15%) and low intensity hard γ rays of 2.2 and 1.6 Mev. The decay of Rh^{105} is accompanied by the emission of 0.08-Mev γ rays. The occurrence of corresponding β and γ transitions in odd nuclei differing by two neutrons is noted. (auth)

775

SYSTEMATICS OF NUCLEAR DECAY. A. Bisi, E. Germagnoli, and L. Zappa (Istituto di Fisica Sperimentale del Politenico, Milan and Laboratori CISE, Milan). Energia nucleare (Milan) 3, 266-86(1956) Aug. (In Italian)

The development of nuclear systematics is made possible because accurate methods of analysis of nuclear radiations are available. In this paper theoretical predictions are reviewed and compared with experimental results. (auth)

776

STUDIES OF K-CAPTURE AND β^--DECAY PROBABILITIES. A. A. Bashilov, N. M. Anton'eva, and B. V. Pshenichnikov (Zhdanov Leningrad State Univ.). Izvest Akad. Nauk S.S.S.R. Ser. Fiz. 20, 348-53(1956) Mar. (In Russian)

Probabilities of K capture and β decay in nuclei with triplet isobars, where the middle isobar is expected to decay into the two end ones, are discussed. For the case of $Os^{192}-Ir^{192}-Pt^{192}$, the probability ratio of Ir^{192} conversion into Os^{192} (K capture) and into Pt^{192}(β^- decay) was shown to be $K/\beta^- \sim 0.04$. Investigations of K capture for Au^{192} and other isobars, and the relative probability of K capture as compared to β^- decay were made by studying the x-ray photoelectrons produced by K capture in γ-ray conversion during β^- decay. The photoelectron spectrum was studied in a magnetic spectrometer, and the X_K/X_{β^-} intensity ratio of X-ray K series in K capture and β^- decay probability for Ir^{192} was found to be $K/\beta^- = 4.5 \pm 1.0\%$, and the upper limit for K capture probability for Au^{198} was less than 0.01% ($K/\beta^- < 1.10^{-4}$). (R.V.J.)

777

INVESTIGATIONS OF A LINE IN ACTIVE RdTh PRECIPITATION. E. M. Krisyuk, G. D. Latyshev, and A. G. Sergeev (Obraztsov Leningrad Inst. of Transportation). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 367-8(1956) Mar. (In Russian)

The A line in active RdTh precipitation is complex and consists of 2 lines, one corresponding to γ conversion at 39.9 kev in the L_1 shell of the Th atom and the other corresponding to γ conversion at 114.7 kev in the K shell of the Bi atom. An attempt was made to divide the lines in a spectroscope (''ketron''). The complete division was not accomplished because the natural width of the K conversion line in Bi is 67 ev and for the L_1 line is ≈10 ev, while the distance between them is ~110 ev. The relative intensity for the L_1 and K lines was calculated as L_1: K ≈ 1.2. (R.V.J.)

778

DISINTEGRATION SCHEME OF Ra^{226} (1620 YR). G. Harbottle, M. McKeown, and G. Scharff-Goldhaber (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1776-7(1956) Sept. 15.

The excited states of Em^{222} were studied in connection with a survey of regularities in heavy even-even nuclei. Em^{222} was shown to have a second excited state of character 2+, 4+, or possibly 0+ at 448 kev. This result was obtained by confirming the existence of a weak γ ray of 260 kev in the Ra^{226} spectrum, which had previously been observed by Stephens in coincidence with Ra^{226} α rays. This γ ray was found to be in coincidence with the well-known 188-kev transition leading from the first excited state (2+) to the ground state. The intensity ratio $I_{\gamma 260}:I_{\gamma 188} = 1:400$. From this ratio and the known value of 5.7% for the α branch feeding the 188-kev state, the intensity of the α branch feeding the 448-kev state was found to be ~0.01%. (auth)

779

DECAY OF A^{41}. A. Schwarzschild, B. M. Rustad, and C. S. Wu (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 103, 1796-1801(1956) Sept. 15.

The β and γ radiations from 110-min A^{41} were investigated with 180° and lens-type magnetic beta spectrometers and a NaI(Tl) scintillation spectrometer. Two β groups are observed with end points of 2.48 ± 0.04 Mev and 1.199 ± 0.008 Mev with relative intensities of 0.88% and 99.1% respectively. The β spectrum of the upper energy group exhibits an α shape in agreement with shell model predictions for the spins of the involved levels. The log f_1t of this transition is 8.50. The gamma-ray energy is 1.290 ± 0.005 Mev. This results in a mass difference of 2.489 ± 0.010 Mev between the ground states of A^{41} and K^{41}. A procedure is described for determining the background contribution in the region of the very weak, high-energy group due to the scattering of β and γ radiation. (auth)

780

ALPHA-PARTICLE AND GAMMA-RAY SPECTRA OF THE

U^{230} DECAY SERIES. Frank Asaro and I. Perlman (Univ. of California, Berkeley). Phys. Rev. 104, 91-9(1956) Oct. 1.

The radiations of the U^{230} family have been investigated with an electromagnetic alpha-particle spectrograph and gamma-ray scintillation counters. The following alpha groups were found: U^{230}—5.884 (67.2%), 5.813 (32.1%), 5.658 (0.7%); Th^{226}—6.330 (79%), 6.220 (19%), 6.095 (1.7%), 6.029 (0.6%); Ra^{222}—6.551; Em^{218}—7.127 Mev. The following gamma rays were seen: U^{230}—72 (0.75%), 158 (0.33%); 232 (0.24%); Th^{226}—112 (4.8%); 131 (0.4%), 197 (0.40%), 242 (1.2%); Em^{218}—609 kev (0.2%). The results are correlated into decay schemes, which are discussed with respect to current systematics and theory of complex alpha spectra and excited states of even-even nuclei. (auth)

781

ELECTRON SPECTRUM OF THE U^{230} DECAY SERIES. W. G. Smith, Frank Asaro, and J. M. Hollander (Univ. of California, Berkeley). Phys. Rev. 104, 99-100(1956) Oct. 1.

The energies of the first excited states of Th^{226}, Ra^{222}, and Em^{218} have been measured as 72.13 ± 0.06, 111.1 ± 0.3, and 324.6 kev with photographic-recording beta-ray spectrographs. The energy of the second excited state in Th^{226} has been measured as 226.4 kev, and a comparison is made with predictions of the Bohr-Mottelson nuclear model. (auth)

782

DECAY OF A^{35}. O. C. Kistner, A. Schwarzschild, and B. M. Rustad (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 104, 154-8(1956) Oct. 1.

The positron decay of A^{35} has been investigated with a magnetic lens beta-ray spectrometer and a NaI(Tl) scintillation spectrometer. A maximum beta-ray energy of 4.96 ± 0.04 Mev was found, which is 0.5 Mev higher than the previous values determined by cloud-chamber measurements. The new value is in good agreement with the end point predicted from Coulomb energy considerations. Two weak gamma rays were found with energies of 1.19 ± 0.04 and 1.73 ± 0.04 Mev; both are in good agreement with reported levels in Cl^{35}. Analysis of the complex beta spectrum shows that approximately 7% of the A^{35} decays of two excited states in Cl^{35}. The ft value of the ground-state, mirror transition is 6200 ± 400 seconds. From this ft value and the ft value of O^{14}, the $|\int\sigma|^2$ for this transition was estimated to be less than 0.13; the e-v angular correlation coefficients were calculated to be $+0.96 \pm 0.04$ and -0.93 ± 0.09 for the V, T and S, T beta interactions, respectively. These coefficients are indistinguishable from those expected in the case of a pure Fermi transition, indicating that A^{35} would be very suitable for identifying the Fermi invariant in the beta-decay interaction by an angular correlation experiment. (auth)

783

THE DECAY OF THE ISOMERIC STATE OF ^{198}Tl. P. S. Fisher and V. Knapp (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A69, 541-7(1956) July 1.

The γ rays from Tl^{198} and Tl^{198m} have been examined with a sodium iodide spectrometer singly and in coincidence. Radiation at 637, 588 and 411 kev, decaying with a period of 1.8 hours, is associated with transitions in Hg^{198} following a 60% K capture branch from the isomeric state Tl^{198m} Tentative spins and parities are assigned. (auth)

784

THE STANDARDIZATION OF RADIOACTIVE PREPARATIONS. K. K. Aglintsev, F. M. Karavaev, A. A. Konstantinov, G. P. Ostromukhova, and E. A. Kholnova. Soviet J. Atomic Energy, No. 2, 199-207(1956).

The article describes methods and apparatus used in the D. I. Mendeleev All-Union Scientific Research Institute of Metrology for the accurate measurement of a number of dosimetric characteristics of radioactive preparations: activity (calorimetric and ionization methods and the method of absolute β-counting), γ equivalent (ionization chamber with 4π solid angle), and the magnitude of the dose of γ radiation (normal ionization chamber). (auth)

785

SYNTHETIC RADIOACTIVE SUBSTANCES IN THE ATMOSPHERE. G. Schumann. Z. angew. Phys. 8, 361-4 (1956) Aug. (In German)

786

THE DECAY OF RaC″ (Tl^{210}). Th. Mayer-Kuckuk. Z. Naturforsch. 11a, 627-30(1956) Aug. (In German)

RARE EARTHS AND RARE-EARTH COMPOUNDS

787

ON TWO TYPES OF LUMINESCENCE SPECTRA OF RARE EARTHS IN ARTIFICIAL FLUORITE CRYSTALS. I. V. Stepanov and P. P. Feofilov. Doklady Akad. Nauk S.S.S.R. 108, 615-18(1956) June 1. (In Russian)

Two types for luminescence spectra were found for fluorite crystals activated by Pr, Sm, Eu, Gd, Tb, Dy, Ho, Er, and Tm. A green line luminescence spectra for CaF_2 activated by Er, and excited by the Hg 365 line at 180°, and ultraviolet luminescence of CaF_2 activated by Gd in a spark photophoroscope at +20° are shown. (R.V.J.)

788

ABSORPTION SPECTRUM AND MAGNETIC PROPERTIES OF YTTERBIUM CHLORIDE. G. H. Dieke and H. M. Crosswhite (Johns Hopkins Univ., Baltimore). J. Opt. Soc. Amer. 46, 885-9(1956) Oct.

The absorption spectrum of $YbCl_3 \cdot 6H_2O$ has two sharp lines near 9700A which are interpreted as the transitions from the M = 5/2 Stark component of the $^2F_{\frac{5}{2}}$ level of the Yb^{+++} ion to the M = 3/2 and 5/2 levels of the other doublet component $^2F_{\frac{7}{2}}$. The Zeeman splittings of the two lines were investigated at 4°K as a function of the orientation of the crystal. They can be interpreted by assuming that the crystal field has a pronounced magnetic symmetry axis (probably sixfold) perpendicular to the twofold symmetry axis of the crystal. The magnetic ellipsoid is degenerate into a pair of planes perpendicular to this axis. The direction of the magnetic axis is slightly different for the three observed states and bears no relation to the optic axes of the crystal. (auth)

SHIELDING

789 AERE-R/R-1943

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DIFFUSION LENGTH OF THERMAL NEUTRONS IN PORTLAND CONCRETE. A. Salmon. Mar. 1955. 14p.

The diffusion length of thermal neutrons in Portland Concrete has been measured to provide fundamental data for shielding studies. The composition and environment of the concrete was measured and is noted. The determined value of the diffusion length was (7.30 ± 0.2) cm. The density of the concrete was (2.23 ± 0.02) gm. cm^{-3}. The diffusion length was thus (7.04 ± 0.21) cm. at a density of 2.3 gm. cm^{-3}. (auth)

790

RADIATION PROTECTION AGAINST A 10 CURIE SOURCE OF COBALT. Arch. Ind. Health 14, 299-300(1956) Sept.

791

SHIELDING OF RADIATION FROM A PLANE CIRCULAR SOURCE. P. M. Ansclone and F. Sobel (Johns Hopkins

Univ., Baltimore). J. Opt. Soc. Amer. 46, 934-40(1956) Nov.

The angular distribution of radiation intensity emitted from a plane circular source is altered by an attached cylindrical shield. Under the assumption of cylindrical symmetry, explicit expressions are obtained for the angular intensity distribution of the radiation emerging from the mouth of the shield. The source is characterized by an intensity which is a function of the point of emission and the direction of emission. The shield is characterized by its length-to-diameter ratio and by the reflectivity of its inner surface. The reflectivity is not necessarily uniform. The general result is an infinite series of integrals over subregions of the source area. For certain cases these integrals are evaluated in terms of elementary mathematical functions. (auth)

792

INSTALLATION OF FIXED SHIELDS IN THE HIGH-ACTIVITY LABORATORY AT SACLAY. R. Fabre and C. Guyot (Centre d'Etudes Nucléaires de Saclay, France). L'Onde Électriques 35, 938-45(1955) Oct. (In French)

The design of the fixed shields at the Saclay hot lab is discussed in some detail. (B.J.H.)

SPECTROSCOPY

793 AECU-3365

RAND Corp., Santa Monica, Calif.

STARK EFFECTS IN LINE BROADENING. Henry Margenau. May 23, 1956. 16p. Contract AT(29-1)-1477. (RM-1779-AEC). $3.30(ph OTS); $2.40(mf OTS).

In classical impact theories, the effect of ions on the width of spectral lines is calculated by supposing that an ion produces a Stark field at the place of the radiating atom, and that the change of this field as the ion moves spreads the radiated frequencies into a small continuum. On the other hand, quantum mechanical calculations based on the customary formulas of the theory of radiation yield line widths which seem to ignore the Stark effect. This was evident where the "universal" effect contained no evidence of second-order Stark contributions but only scattering by Hartree potentials between atom and electron. First-order Stark effects, called polarization, were in some results; they arise from the combination of degenerate states which were included in the calculation. Higher excited states were ignored, and the impression might arise that their inclusion in the ordinary formalism would automatically yield the quantum analogue of the second-order Stark effect obtained by impact theories. This is not the case. Higher atomic states make contributions to the line width only if they can actually be excited, i.e., if the impinging ions are sufficiently energetic or the temperature is high. The effect is then one of quenching the optically active state rather than of Stark perturbations. The reason for this strange result lies in the fact that radiation theory makes use of what is sometimes called the "sudden approximation:" it assumes none of the upper states to be excited at time t = 0 and then switches on the perturbation. Under these conditions, ordinary perturbation theory likewise falsifies the second-order Stark effect. This difficulty is exhibited and a method for its removal with the use of wave packets for the perturbing ions is demonstrated. (auth)

794 AEC-tr-2561

EXPERIMENTAL STUDY OF THE TEMPERATURE DEPENDENCE OF THE INTENSITY OF THE STOKES' LINES ARISING FROM FIRST ORDER COMBINED DISPERSION. Ya. S. Bobovich. Translated from Doklady Akad. Nauk S.S.S.R. 98, 39-42(1954). 4p.

The problem of the degree to which this anomaly is conditioned by the character of the vibrations and the properties of the chemical bonds is investigated. (T.R.H.)

795 AEC-tr-2578

THE EMISSIVITY OF SPECTRAL LINES OF METAL VAPORS IN A FLAME (abstract). V. V. Kandyba. Translated from Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 18, 256 (1954). 2p.

796

THE CONVERSION SPECTRA OF HIGH ENERGY OF Hg^{195} AND Hg^{193}. J. Brunner, J. Halter, and H. J. Leisi (ETH, Zürich, Switzerland). Helv. Phys. Acta 29, 238-40(1956) July. (In German)

797

DOUBLE FOCUSING BETA SPECTROMETER OF NEW DESIGN. H. Wild and O. Huber (Physik Institut der Universität, Fribourg, Switzerland). Helv. Phys. Acta 29, 244-5(1956) July. (In German)

798

MAGNETIC γ SPECTROMETER WITH IMPROVED FOCUSING—THE ELOTRON. B. S. Dzhelepov and S. A. Shestopalova (Mendeleev All Union Research Inst. of Metrology). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 328-46(1956) Mar. (In Russian)

The design and operation of a magnetic γ spectrometer with improved focusing ("the elotron") are described. The data do not offer exhaustive information of the "elotron" properties but may be useful in construction of a similar apparatus. (R.V.J.)

799

CALCULATIONS OF MEAN SPECTRA LIFE OF ADMIXTURE CENTERS AND LOCALIZED EXCITATIONS IN EXCITED STATES. A. F. Lubchenko. (USSR Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 388-91(1956) Apr. (In Russian)

Systematic application of electrodynamic methods in investigations of the optical properties of solutions and molecular crystals permitted a determination to be made of the shape of the absorption and luminescence bands for the admixture centers and their excitations, their changes with temperature, the symmetry of their bands in relation to the electron transition frequency, and the mean spectra life of the admixture centers and localized excitations in excited states. (R.V.J.)

800

SCINTILLATION SPECTROMETRY OF SOFT X RADIATION. W. Kolb. Naturwissenschaften 43, 53-4(1956) Feb. (In German)

801

SOLAR BATTERIES. (ON THE DIRECT TRANSFORMATION OF RADIANT ENERGY INTO ELECTRICAL ENERGY BY MEANS OF PHOTOELEMENTS.) V. S. Vavilov. Soviet J. Atomic Energy, No. 3, 399-408(1956).

Consideration is given to the possibilities of direct transformation of the energy of solar radiation into electrical energy by means of semiconducting photoelements. Brief descriptions are given of the main electrical and optical properties of germanium and silicon, and of methods for producing them and controlling their electrical properties by the introduction of small amounts of impurities. The principle of action of photoelements with electron-hole junctions is discussed, and the basic parameters determining their spectral sensitivity and efficiency are indicated. Data are presented on the action of experimental solar batteries as generators of current. (auth)

THEORETICAL PHYSICS

802 AEC-tr-2508

APPLICATION OF THE RENORMALIZATION GROUP TO

IMPROVEMENT OF FORMULAS IN PERTURBATION THEORY. N. N. Bogoliubov and D. V. Shirkov. Translated from Doklady Akad. Nauk S.S.S.R. 103, 391-4(1955). 8p.

803 AEC-tr-2639

ON THE RENORMALIZATION GROUP IN QUANTUM ELECTRODYNAMICS. N. N. Bogoliubov and D. V. Shirkov. Translated from Doklady Akad. Nauk S.S.S.R. 103, 203-6 (1955). 9p.

Renormalization groups from quantum electrodynamics were used to obtain formulas which permit proceeding from the results of a general theory of perturbations to the region of large impulses and to the region of infrared catastrophe. (F.S.)

804

ON THE THEORY OF HEAVY NUCLEUS EXCITATION ENERGY. L. P. Rapoport and Yu. M. Butusov (Voronej State Univ.). Doklady Akad. Nauk S.S.S.R. 108, 1037-40 (1956) June 21. (In Russian)

A model of Fermi ideal gas enclosed in a potential well with nuclear and depth dimensions of 35 Mev was used in previous calculations of the excitation energy of heavy nuclei. Such a model did not account for the nuclear interactions and neglected to consider the surface effects. A calculation method is offered in which the model combines the individual and collective nuclear motion properties. A coordinate system in which the single and collective motions were divided and the total number of degrees of freedom did not exceed 3A, was applied in the calculations. (R.V.J.)

805

ON A CERTAIN MODEL IN QUANTUM FIELD THEORY. V. G. Solov'ev (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 108, 1041-4(1956) June 21. (In Russian)

Studies are made of a new model which may be obtained from the couple-limitation technique, previously introduced into the quantum field theory by A. A. Abrikosov, Doklady Akad. Nauk S.S.S.R. 103, 933(1955), and by accepting the threshold of meson impulse as $\lambda \varphi$ equal to zero, and the threshold of nuclear impulse as $\lambda \varphi$ striving to infinity. The equation for the Green function of the proposed new model was solved with good accuracy. (R.V.J.)

806

NON-RELATIVISTIC RENORMALIZATION OF S-MATRIX. B. M. Stepanov. Doklady Akad. Nauk S.S.S.R. 108, 1045-7(1956) June 21. (In Russian)

807

MULTIPLE QUANTUM TRANSITIONS OF A SYSTEM OF COUPLED ANGULAR MOMENTA. M. N. Hack (Princeton Univ., N. J.). Phys. Rev. 104, 84-8(1956) Oct. 1.

The transition probabilities of the multiple quantum transitions of a system of coupled angular momentum vectors in a uniform static plus perpendicular rotating magnetic field are studied both in the uncertainty width region, by time-dependent perturbation theory, and at higher amplitudes of the rotating field, by direct integration of the Schrödinger equation, in the case of well-separated resonance frequencies. (auth)

808

INSENSITIVITY OF THE SCATTERING MATRIX. H. Ekstein (Armour Research Foundation, Chicago) and Katsumi Tanaka (Argonne National Lab., Lemont, Ill.). Phys. Rev. 104, 259-63(1956) Oct. 1.

It is conjectured that the S matrix, expressed in terms of rigorous one-particle states, is insensitive to a substitution for the rigorous one-particle states of any approximate state which, by adiabatic switching-on of the interaction, is carried into a rigorous one-particle state. This conjecture, first suggested by the fact that the usual form of the S matrix contains bare-particle states, is supported by the proof that the S-matrix element between one bare and one "real" particle (e.g., bare meson and real nucleon, bare nucleon and real meson, one bare and one real nucleon) is exactly correct. The equivalence of our S-matrix element with Low's form of the S-matrix element for nucleon-meson scattering is one of the above cases. It is pointed out that great simplifications in calculations could be secured if the conjecture were verified. (auth)

809

MATRIX ASPECTS OF BOSON THEORY. A. A. Borgardt (Dnepropetrovsk State Univ.). Soviet Phys. JETP 3, 239-43 (1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 334-41(1956) Feb. (In Russian)

Certain relations are presented which make it possible to change at any stage of a calculation from anticommuting matrices to Kemmer matrices. The paper shows the connection between the Γ_μ, the matrices of the irreducible representation of the Kemmer and Dirac algebra, and also the Tamm matrices. (auth)

810

QUANTUM FIELD THEORY. H. Umezawa. New York, Interscience Publishers, Inc., 1956. 364p. Amsterdam, North-Holland Publishing Co.

Various aspects of quantium field theory, including a historical discussion and leading up to the latest developments, are discussed. A detailed study of the theory of propagators is included. (J.H.M.)

URANIUM AND URANIUM COMPOUNDS

811 BMI-1069

Battelle Memorial Inst., Columbus, Ohio.

A STUDY OF INTERNAL FRICTION AND TWIN-BOUNDARY MOVEMENT IN URANIUM. Robert E. Maringer, Lyle L. Marsh, and George K. Manning. Jan. 30, 1956. Decl. Mar. 12, 1956. 34p. Contract W-7405-eng-92. $4.80(ph OTS); $2.70(mf OTS).

The internal friction of recrystallized U was shown to depend directly on heating and cooling rates and on the rate of application or removal of an external stress during measurement. At zero heating or stress rate, the internal friction falls to a low value and appears to decrease indefinitely at room temperature. Micrographs showing twin disappearance on removal or reversal of load are shown. Results are compared with similar experiments on assuaged U and other metals. It is concluded that the various internal-friction phenomena are the result of the stress-induced motion of twin boundaries. (auth)

812 BMI-1124

Battelle Memorial Inst., Columbus, Ohio.

SURVEY OF REFRACTORY URANIUM COMPOUNDS. Luther D. Loch, Glen B. Engle, M. Jack Snyder, and Winston H. Duckworth. Aug. 7, 1956. Decl. Sept. 18, 1956. 32p. Contract W-7405-eng-92. $0.35(OTS).

Chemical and physical data on twenty binary U compounds that may prove suitable for refractory nuclear fuels were assembled. The compounds were those with Al, B, C, Fe, Ni, N, Si, or S. Too little is known at this time about the compounds to evaluate any of them for fuel. The program is being extended in an effort to provide the needed data. (auth)

813 CF-56-8-201

Oak Ridge National Lab., Tenn.

PARAMETERS FOR TWO GROUP ANALYSIS OF CRITICAL EXPERIMENTS WITH WATER REFLECTED SPHERES OF UO_2F_2 AQUEOUS SOLUTIONS. J. T. Thomas. Aug. 30, 1956. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

814 NP-6133

Penn-Texas Corp., New York.

URANIUM OXIDE: A BIBLIOGRAPHY. Helen C. Friedemann. Sept. 15, 1956. 10p.

A bibliography on UO_2 fuel elements, containing 97 references published since 1953, is presented. (J.E.D.)

815

LUMINESCENCE OF URANYL SALT SOLUTIONS. A. N. Sevchenko and L. V. Volod'ko (Inst. of Physics and Mathematics, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. 20, 464-70 (1956) Apr. (In Russian)

Experimental data on spectra for organic uranyl complexes in solutions or crystals show the presence of strong thermal quenching. The process of photoluminescence quenching varies with the changes in organic parts of molecules and depends on the chemical composition of the solvent. (R.V.J.)

816

EXPERIMENTS ON THE INELASTIC SCATTERING OF NEUTRONS BY URANIUM. R. Batchelor (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A69, 214-20(1956) Mar. 1.

A helium 3 neutron spectrometer has been used to study the spectrum of neutrons inside a spherical U shell, 3 cm thick, when the latter is bombarded with monoenergetic neutrons of various energies between 500 kev and 1.0 Mev. The spectra of neutrons scattered inelastically and also the cross sections for this process have been derived, and the results compared with those predicted by current nuclear theory. Evidence for the existence of the low-lying rotational levels of U^{238} is presented, and at least one new level at 700 kev (and possibly more at higher energies) has been found. Qualitative confirmation has been obtained by measuring the spectrum of neutrons from a U shell, 11.5 cm thick, with a neutron source in the center. (auth)

817

PARAMAGNETIC RESONANCE OF URANIUM IONS. B. Bleaney and P. M. Llewellyn (Univ. of Oxford, England) and D. A. Jones (Aberdeen Univ., Scotland). Proc. Phys. Soc. (London) B69, 858-60(1956) Aug. 1.

Paramagnetic resonance was observed at 20°K in single crystals of CaF_2 and SrF_2 containing small quantities of U and Nd as impurities. The CaF_2 crystals were grown by the Stockbarger method in a vacuum furnace from powdered, colorless, natural fluoride previously mixed with ~0.1% by weight of U or Nd fluoride; a similar method was used for SrF_2 crystals but the percentage was ~1%. In each case, the resonance spectrum shows three types of magnetic ion each with axial symmetry about one of the cube axes. Values of $G_{\parallel}$ and $G_{\perp}$ were determined for both U and Nd. (auth)

818

NENADKEVITE—A NEW URANIUM SILICATE. V. A. Polikarpov. Soviet J. Atomic Energy, No. 3, 425-7(1956).

A description is given of the properties of the new uranium mineral—nenadkevite, which was discovered in the USSR in 1952. This mineral is a member of the silicate group and is in reality a continuous isomorphic series. It is postulated that it is, in addition, the last member of the thorite group and the richest in uranium. (auth)

819

HYDROPITCHBLENDE AND URGITE—NEW HYDROUS URANIUM OXIDES. R. V. Getseva. Soviet J. Atomic Energy, No. 3, 429-30(1956).

A description is given of two new uranium minerals discovered in the USSR in 1947—hydropitchblende and urgite. These minerals are hydrous uranium oxides and are members of a single series in the successive oxidation and hydration of pitchblende. They are compounds of varying composition. (auth)

820

THE ELECTRON SPECTRUM OF U^{237}. S. A. Baranov and K. N. Shliagin. Soviet Phys. JETP 3, 200-5(1956) Sept. (In English). Zhur. Eksptl.' i Teoret. Fiz. 30, 225-30(1956) Feb. (In Russian)

The electron spectrum of U^{237} was investigated on a $\pi\sqrt{2}$ focussing angle magnetic β spectrometer, beginning with electron energies of 1 kev. Two components of the spectrum were determined, with energy limits E_{OA} = 84 kev (26%) and E_{OB} = 249 kev (74%). The following γ transitions for N_p^{237} were computed from the conversion electron lines; 26; 33; 43; 60; 69(?); 101(?); 124(?); 165; 193(?); 208; 267; 331; 370 and 436 kev. A tentative decay scheme of U^{237} is given. (auth)